A REPORT ON

CONTENT ENRICHMENT PROGRAMME IN GENERAL SCIENCE FOR RESOURCE PERSONS AT SECONDARY LEVEL

HELD AT

Post-Graduate Teacher Training College

Boyce Road, Shillong-3

From 27.1.1994 to 3.2.1994

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My thanks are due to all my colleagues, for their timely help without which the programme would not have been successful.

The help rendered by Dr.M.M.Pandey, Field Adviser, NCERT, Shillong is gratefully acknowledged. Last but not the least, I also take this opportunity to thank Dr.G.P.Wahalang, Education Commissioner, Meghalaya who could spare his valuable time for the Validiction of the Programme.

Above all active participation of the participants to make the Programme a success is also gratefully acknowledged.

(G.V. Gopal)
Programme Co-Ordinator

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CONTENT ENRICHMENT PROGRAMME IN GENERAL SCIENCE FOR RESOURCE PERSONS AT SECONDARY LEVEL

Venue:- Shillong Date:-27.1.94 to 3.2.94

APPROACH PAPER

Potential of Education to contribute to Social development is well comprehended by the Indian planners, educationists, and policy makers. The National Policy of Education (1968) envisages the importance of science education. If you look back into our past Education Report, i.e. Kothari Commission 1964-66 the relevance of good science education is manifold.

If science is poorly taught and badly learnt, it is little more than burdening the mind, with dead information and it could degenerate even into a new superstition.

The 1968 Policy document aimed to promote national progress and strengthening the educational system by improving its quality at all stages, gave much greater importance to universalization of science education at Primary, and Secondary levels. New Education Policy (NEP) document laid stress on the quality up-gradation of science education and science teaching in the country.

Science education is infact considered as a process which helps individuals and the community in gaining awareness of their society, environment, economic growth, Natural resources, Agriculture and in acquiring knowledge, skill, and experiences of scientific knowledge. Science education helps in developing determination within individuals which enables them to act both individually and collectively

in solving the present day problems. So it goes without saying that a minimum knowledge of general science is to be imparted to all groups of people, so that this knowledge can be of use to those individuals who dropout from the school system. Thus the role of science education and science teacher becomes more important in creating consciousness among the students and public.

It is envisaged that education without science as a basic component in the school system is going to cause a serious set back.

The N.P.E. Programme of action 1986 has amply emphasised the need for universalization of science education at Primary and Secondary levels for the success of science education in the school system.

The teacher should himself possess the cognitive skills and effective attributes, to be imparted to the students at all levels in general and secondary levels in particular. These acquired attributes should help the teachers to know, understand and secondly solve the problems of themselves and of the neighbourhood.

Keeping the above views in mind that the present programme of content enrichment has been organised for teachers of Meghalaya, Mizoram and Tripura states together to keep them abreast of the recent developments and technical advancement in science and technology.

It is generally felt that the effectiveness of implementation of science education is likely to diminish without adequate teachers training and orientation programmes.

The Regional College of Education is conducting through the extension service department an eightday programme entitled "Training Programme for Key Resource Persons in general Science at Secondary level for Tripura, Mizoram and Meghalaya states during 27.1.94 to 3.2.94. We have invited 30 participants, ten representing from each State. During this programme the participants will be exposed to different topics in Biological Sciences and Physical sciences to update their knowledge.

The main objectives of the programme are as follows:

(A) To update the scientific content knowledge of Biological and Physical sciences among Key - Resource Persons who in turn can transact the same in training teachers at Secondary level.

(B) To impart Pedagogical skills in science teaching.

(C) To impart skills/methods in conducting laboratory activities related to the curriculum.

Working Plan: The participants belonging to physical and Biological sciences would be treated as one group and will be addressed in both biological and physical science topics. Besides the content transaction, a thread bearing discussion will be undertaken on the topics, and laboratory-cum-field exercises related to the content areas will be taken up during the eight days programme.

Some of the identified topics in various branches are as follows:

Biological Sciences: Food production, Plant physiology, Animal physiology, in crop plants.

RBC, WBC, Hemoglobin, concept of ecosystem and energy flow in ecosystem, Nutrition. Plant tissue and tissue- culture. Conservation of plants and Biomass as fuels.

Physical Sciences:

Physics: Force, acceleration and motion, optics, electricity and application, waves, heat, gravitation, sun and nuclear energy.

Chemistry: Atomic theory and structure, classification of elements, chemical bonding, energy changes and chemical reactions, Metals and Metallurgy. Allotropy of carbon and study of hydrocarbon.

It is expected that with the active Co-operation of the participants and the valuable contributions of the resource persons in the content area would enrich the participants positively and thus the aim of the programme will be achieved.

(G.V. Gopal)
Lecturer in Botany &
Programme Director

HIGHLIGHT OF THE CONTENT ENRICHMENT PROGRAMME IN GENERAL SCIENCE FOR RESOURCE PERSONS AT SECONDARY LEVEL HELD AT SHILLONG FROM 27.1.94 TO 3.2.94.

The Programme was held at Post-Graduate Teacher Training College, Boyce Road, Shillong from 27.1.94 to 3.2.94. The main aim of the programme is to enrich the resource persons in different areas of science and pedagogy. The various disciplines of science like Physics, Chemistry, Botany and Zoology were discussed. The programme was organised as per the request of the State of Tripura, Meghalaya and Mizoram.

The Programme became a necessecity because the three states are going to adopt shortly the C.B.S.E. syllabus. This training was very useful as expressed by the participants. The following objectives were achieved because of the successful transaction during eight-day stay at Shillong:

(a) Content enrichment in different areas of General Science (Botany, Zoology, Physics and Chemistry).

(b) Modes of effective classroom communication and Methodology of science teaching.

(c) Appraisal of recent trends in industrial chemistry.

(d) The process of the development of scientific attitude and method.

(e) Solution to specific local problems related to science teaching.

Methodology followed in th. Training Programme.

The Programme was inaugurated on 27.1.94 at P.G.T. College, Shillong, with a warm welcome to participants by Dr.H.H.Tripathy, followed by the address of the Chief Guest Dr.C. Wolflang, Director, SCERT, Shillong. In his inaugural address he expressed his concern about the rich economic potential of the State. It has to be utilized scientifically, he stressed. The scientific utilisation of the resources would be possible only through effective ways of teaching and learning science.

Presiding over the function Dr.M.M.Pandey, Field Adviser,NCERT, stressed the need for such Orientation Courses so as to upgrade teaching competence. He laid emphasis an all concerned for the improvement of science education at school level. He advised the teachers to evolve innovative practical methods to communicate science more effectively at school level. Dr.U.K. Nanda proposed vote of thanks. For the 8-day training programme altogether fourteen participants turned up from the three States.

The broad areas from General Science were selected and theory and practicals aspects of these have been transacted. The topics related to Chemistry are discussed by Dr.H.H.Tripathy. The topics were discussed:- Atomic theory and structure, Classification of elements, Chemical bonding, Energy changes and chemical reactions, Metals and Metalurgy, Allotropy of carbon and study of hydrocarbons. Dr.B.K.Parida

dealt with Physics and those were unimotion, Force, work and energy, Solar system and Application of Physics in Biology. Botany portion was transacted by Dr.G.V.Gopal; Tissue Culture, Vegetative propogation, Food crops and production, Bio-technology of preservation of food grains, Bactorial staining (Gram positive and Gram negative method) , Photosynthesis, and P.D.A. medium preparation for bactorial culture. Zoology by Dr.U.K.Nanda; Ecosystem, Foodchain, Food web, Ecological pyramids and energy flow in ecosystem, Nutrition, Haemoglobin concentration, R.B.C. in human blood.

Methods of science teaching was transacted by Dr.S.C.Panda. The topic discussed were Meaning and nature of concept and principles, Managing classroom topics, Information processing and theory and principles of effective communication. Dr.C.Wolflang, Director, SCERT gave a Guest lecture on development of Scientific temper and science teaching. The participants were actively involved in different activities conducted during the programme. The Valedictory address was given by Sri G.P.Wahalang, Education Commissioner, Meghalaya, Shillong.

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INSTRUCTIONAL MATERIAL

PREPARATION OF MEDIA FOR MICROBIAL CULTURES

1. Medium:- Material on, or in which micro-organisms are grow n in the laboratory is called medium.

2. Culture:- Cultivation of a micro-organism in group. This group may be of lanogenous or heterogenous gro[illegible].

3. Pure Culture:- When the cultivation is only of lanogenous group or all similar or only one Rind of organism it is called pure culture.

4. Requirements for the preparation of 1000 c.c. of P.D.A. (Potato dextrose Agar media).

A. Chemicals:-

(i) 20 gms of Agar

(ii) 20 gms of Dextrose (Sugar)

B. Natural food source - 50 gms of Potato.

C. Glasswares

(i) Petri dishes in pairs

(ii) Conical flask 500 c.c.-two

(iii) Conical flask 1000 c.c.-one

(iv) Beaker 500 c.c. - Two

(v) Glass Rods 10-20 c.m. - Two

D. Instruments and other materials:

(i) Non-absorbtant cotton 1 packet of 100gms.

(ii) Pressure cooker of 10 litre capacity.

(iii) Gas burner or electrical heater.

(iv) Source of water.

5. Procedures

(i) Weigh 50 gms of Potato. Clean it but do not peal.

(ii) Cut into small pieces (1-2 cm) put it in a beaker, add 200 c.c. of water. Heat it slowly for about 1/2 hrs. till it starts forming water turbid. Filter the whole material through piece of cloth and take the decount in a 1000 c.c. conical flask.

(iii) Dissolve 20 gms of Agar in a beaker. Agar may not dissolve at room temperature. Boil the solution taking water not more than 1

(iv) Dissolve Dextrose (sugar) in another 1 of water.

(v) Put the Agar and dextrose solution in the flask with decent of boiled potato. Add more water to make 1000 c.c.

(vi) Plug the flask with cotton tightly. Put oil paper around its neck and tie it with threads.

(vii) Sterlise it in the pressure cooker for minimum 1/2 hr. , at 15 lb pressure and 120°C temperature.

(viii) Sterlise (see serial 6.) the petridishes and pour 5 c.c. of media in each petridish only in the inoculation chamber.

Note:- If inoculation is done immediately put the inoculated petri-dishes in culture tube after marking them with glass marking pencil. Resterilise the un-used medium.

Precaution:- Put sufficient water in the pressure cooker and open carefully.

6. Sterilisation of Petridishes:-

(i) Clean desired number of pairs of petridishes.

(ii) Wrap them with normal newspaper or any ordinary paper and tie them.

(iii) Put individual pairs in a wire basket.

(iv) Put the basket in the pressure cooker.

The basket should be placed on a raised platform above water level.

(v) Close the pressure cooker properly.

(vi) Sterlise it for 1/2 hrs minimum.

(vii) When the pressure cooker comes to normal temperature take out the petridishes but open the wraping in the inoculation chamber only.

Pre-caution:- Put sifficient water in the pressure cooker and open it carefully.

7. Culture of Bacteria (Carrot/Potato):- Cut cubical pieces (1-2 cm.). put them in a beaker containing water. Make them half boil. Remove them and put in a petridish with water soaked blotting paper at the bottom. Cover it. See after 3-4 days.

8. Staining of bacteria:- Bacteria can be stained with Methylene blue solution (Single stain) but a more elaborate system of stain is used known as Gram stain. Gram stains are used to distinguish between gram positive and gram negative bacteria.

Procedure:- Make a smear of bacteria on a slide. Dry it up. Flood it with Methylene blue for one minute (single stain) wash it slowly under the tap water. Mount it with glycerine and see under high power.

For Gram stain the smear is first flooded with crystal violet solution. Then it is washed with tap water slowly. Stain it with iodine solution. Wash it with alcohol. Put saffranine for a minute. Wash it slowly under tap water. Mount it in the glycerine and see under high power. Here some bacteria are taken crystal violet colour and are not decolourised after washing with alcohol. They are gram positive bacteria. Some bacteria are stained pink or red with saffranine because their crystal violet colour has been washed with alcohol. They are gram negative bacteria.

INSTRUCTIONAL MATERIAL NO.1

(i) Dissolve Dextrose (sugar) in another 100 c.c. of water .

(ii) Put the Agar and dextrose solution in the flask with decent of boiled potato. Add more water to make 100 c.c.

(iii) Plug the flask with cotton tightly. Put oil paper around its neck and tie it with threads.

(iv) Sterlise it in the pressure cooker for minimum 1/2 hr. at 15 lb pressure and 120°C temperature.

(v) Sterlise (see serial-6) the petridishes and pour 5 c.c. of media in each petridish only in the inoculation chamber.

NOTE: If inoculation is done immediately, put the inoculated petri-dishes in culture tube after marking them with glass marking pencil. Re-sterlise the un-used medium.

Precaution: Put sufficient water in the pressure cooker and open carefully.

6. Sterlisation of Petri-dishes :-

(i) Clean desired number of pairs of petri-dishes

(ii) Wrap them with normal newspaper or any ordinary paper and tie them.

(iii) Put individual pairs in a wire basket.

(iv) Put the basket in the pressure cooker. The basket should be placed on a raised platform above water level.

(v) Close the pressure cooker properly.

(vi) Sterlise it for 1/2 hrs minimum.

(vii) When the pressure cooker comes to normal temperature take out the petridishes but open the wraping in the inoculation chamber only.

Precaution: Put sufficient water in the pressure cooker and open it carefully.

7. Culture of Bacteria (Carrot/Potato):-

Cut cubical pieces (1-2 c.m.). Put them in a beaker containing water. Make them half boil. Remove them and put in a petridish with water soaked blotting paper at the bottom. Cover it. See after 3-4 days.

INSTRUCTIONAL MATERIAL NO.1

8. Staining of bacteria

Bacteria can be stained with Methylene blue solution (Single stain) but a more elaborate system of stain is used know as grave stain. Grave stains are used to distinguish between grave positive and grave nagative bac-teria.

Procedure: Make a smear of bacteria on a slide.Dry it up, folld it with methylene blue for one minute (single stain) wash it slowly

under the tap water. Moist it with glycrine and see under high power.

For grave stain the smear is first flooded with crystal violet solution.

9. Though it is washed with tap water slowly. Stain it with iodine solution. Wash it with alcohol. Put saffranine for a minute. Wash it slowly under tap water. Moist it in the glycerine and see under high power. Here some bacteria are take crystal violet colour and are not decolourised after washing with alcohol. They are grave positive bacteria. Some bac teria are stained pink or red with saffranine because their crystal voilet colour has been washed with alcohol. They are grave negative bacteria.

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CULTURE AND STAINING OF BACTERIA

A: CULTURE

Aim:- To culture bacteria on a simple media and

Requirements:

1. Potato/Carrot
2. Sheet of blotting paper
3. A long glass rod.
4. Paired petridishes
5. Beaker
6. Heater/burner

Procedure:

1. Cut cubical pieces of carrot or potato about 1-2 cm^3.
2. Boil them in a beaker till half cooked.
3. Line the base of petridishes with wet blotting paper and place. The half boiled vegetable cubes and cover with lid.
4. Observe after 3-4 days.

B: STAINING

Aim:- To demonstrate single staining and gram staining of bacteria.

Requirements

1. Methylene blue
2. Crystal violet stain:

   Soln A Crystal violet (90% dye content) -2 g
   Ethanol (95%) -20 ml.

   Soln B Ammonium exalate 0.8 g
   Distilled water 80 ml

   Mix solutions A and B before use

3. Safranine stain

Safranine - 2.25 g

Ethanol (95%) - 225 ml.

4. Iodine solution

Iodine - 2g

Potassium iodide -

Distilled water - 100 ml.

5. Alcohol

6. Glycerine

7. Slides and coverslip

8. Microscope

Procedure:

(a) Single staining

1. Make a smear of bacteria on a slide.
2. Dry the smear and flood with methylene blue for one minute.
3. Wash gently under running water.
4. Mount in glycerine and observe under high power of the microscope.

(b) Gram's staining

Gram staining is used to distinguish between gram positive and gram negative bacteria.

1. Flood a dry bacterial smear with crystal violet solution.
2. Wash gently under running water.
3. Stain with iodine solution.
4. Wash with alcohol
5. Stain with saffranine for a minute.
6. Wash gently under running water.
7. Mount in glycerine and observe under high power.

Those bacteria which are stained with crystal violet colour, and are not decolourised after washing with alcohol are termed gram positive. These which stain pink or red with saffranine because the crystal violet stain had been washed out, are called gram negative bacteria.

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PLANT TISSUE CULTURE AND ITS APPLICATIONS

'Tissue culture' is a general term that encompasses and is concerned with the study of not only tissues but also cells, protoplasts and organs maintained or grown *in vitro*. Tissue culture techniques should, thus more accurately, be termed as IN VITRO techniques (meaning literally in a glass) because the cultures are normally contained within glass or clear plastic vessels. Although in vitro culture is relatively a new branch of biological science it is based on the concept of "Totipotency of living cells", a theory put forth by the German botanist Dr.G.Haberlandt during the beginning of the current century (1902). Totipotency may be defined as the 'inherent capacity of a living cell to divide, develop and differentiate into the total range of cell types found in the adult organism" . A diploid Zygote formed as a consequence of fertilization is a single cell and has the potential to form all the types of cells in the body; therefore, it is totipotent. All other cells derived from a Zygote or its daughter cells express their genetic potential less completely, and such expression is progressively restricted at the later stage of tissue and cell differentiation. Never-the-less, it has been demonstrated that differentiated cells are capable of acting like zygotes under certain tissue culture conditions. They are then said to have demonstrated totipotency. Dr.Haberlandt failed in his experimental works and could not prove his concept of totipotency. It was so mainly because his ideas were far ahead of the technologica l know-how available at that time.

However, later, during the 1930S the subject was put on a scientific footing through the works of Dr.R.J. Gautheret in France and Dr.P.R.White in the U.S.A. In the following years Plant tissue culture techniques have undergone tremendous refinement and plants belonging to virtually all families and groups have been successfully put to tissue culture experiments. To-day, in vitro techniques are considered to be one of the front-line tools for undertaking researches in genetic engineering.

TYPES OF IN VITRO CULTURES AND THEIR APPLICATIONS:

As has already been pointed out, the term 'tissue culture' or 'in vitro' culture is a general-term. Plant tissue culture recognises three main branches.

1. Cell culture:- This term is used to denote the growing of cells in vitro including the culture of single cells. In cell cultures, the cells are no longer organised into tissues.

2. Tissue culture:- The maintenance of growth of tissues in vitro, in a way that may allow differentiation and preservation of their architecture and/or function.

3. Organ culture:- The maintenance or growth of organ primordia or the whole or parts of an organ in vitro in a way that may allow differentiation and preservation of the architecture and/or function.

In tissue culture parlance, however, one frequently comes across a number of other popular terms.The

following is an account of some of these terms.

(A) Micropropagation:- This refers to in vitro clonal propagation of shoots during several subcultures. Clonal propagation is nothing but asexual or vegetative reproduction of plants that are, in general, genetically uniform and originated from a single individual or explant. All members obtained through this method are called 'clones' of the original individual. A tissue or organ is called an 'explant' when it is taken from its original site and transferred to an artificial environment for growth or maintenance. In micropropagation miniature shoots or plantlets are initially derived which when transferred to greenhouse or field conditions attain the normal size. There are four distinct stages of micropropagation.

STAGE - I : Establishment of an aseptic tissue culture of a plant.

STAGE -II : A step characterized by the rapid numerical increase of organs or other structures.

STAGE-III : Preparation of propagule for successful transfer to soil, a process involving rooting of shoot cuttings, hardening the plants and initiating the change from heterotrophic to autotrophic state.

STAGE - IV: Establishment in soil of the tissue culture derived plant.

Micropropagation is usually very much more rapid then the traditional methods. It cannot only provide increased rate of prepagation but can facilitate vegetative multiplication of plants that had previously been proved difficult or impossible to propagate. The

efficiency and reliability of vegetative propagation through micropropagation is important for a number of reasons.

1. In many species now hybrid cultivars arise as single plants, either through selection during breeding programme or as a result of chance mutation; these require multiplication as quickly as possible for testing and eventual commercial application.

2. Plants obtained through conventional vegetative propagation are liable to accumulate systemic viral, bacterial or fungal infections; disease free individuals obtainable only in small numbers will similarly need rapid multiplication.

3. In breeding programmes it is sometimes desirable to perpetuate particular unique genotypes.

4. In large scale hybrid seed production, genetically uniform parent plants are required in large numbers.

Thus micropropagation can play an important role in agriculture and commercial horticulture.

(B) Organogenesis, adventitious regeneration:

'Organogenesis' is a process of differentiation by which plant organs are formed de novo. In developmental biology, this term refers to differentiation of an organ system from some precursor tissues or cells. Similarly, 'regeneration' in vitro is a morphogenetic response to a stimulus that results in the production of organs, embryos or whole plant. The term 'adventitious' on the other hand, refers to the development of something

from an unusual or abnormal point of origin, e.g. shoots or root from callus, shoots from leaves, embryos from tissues other than a zygote. On some specific nutrient media when a tissue is cultivated, due to dedifferentiation an unorganized, proliferative mass of plant cells is produced. This mean is somewhat like that we see in case of a wound response in plants; it is called a 'callus'.

Organogenesis and regeneration in vitro have many aspects of interest for scientists of both basic and applied areas of plant science. Improvement of crop plants through manipulations at the cellular level is possible only if somatic cells are able to give rise to whole plants; a plant breeder is obviously interested to obtain modified plants rather than modified cells. An in vitro system will offer enough scope to investigate the basic physiology and biochemistry of organogenesis and morphogenesis in different plant species.

(C) Somatic Embryogenesis & Synthetic seeds:

The process of embryo initiation and formation from cultures of vegetative (somatic or non-gametic) cells is called as in vitro 'somatic embryogenesis'. In culture conditions, in certain instances, the vegetative cells which, infact, are the derivatives of the zygotic cell, behave like the zygote and form embryos. These embryos are called 'somatic embryos'. Some times in culture conditions number of new embryos are formed on the body of the somatic embryo. This phenomenon is called 'adventive somatic embryogenesis' or 'secondary somatic embryogenesis'

Regeneration of plants through the embryogenic pathway is of special significance in mutagenic studies. Unlike the shoots regenerated through organegenesis, somatic embryos arise from single cells and therefore, the new strains of plants obtained through adventive embryogenesis in tissue cultures would be solid mutants. Since somatic embryos can be produced in large numbers it can be adopted as an alternate method for micro-propagation. Somatic embryos are of typical bipolar nature and resemble the zygotic embryos found in the seed. Now-a-days, biotechnologists are working on the possibilities of producing 'artificial or synthetic seeds' from somatic embryos of important agricultural and forest plants. In 'synthetic seed', a somatic embryo is generally encapsulated in some nutrient gel which acts as the endosperm for the sometic embryo. These synthetic seeds can be stored, and transported easily and can be shown in the field beds directly.

(D) Haploid embryogenesis and Purelines:

Like the somatic cells, the gametic cells (the pollen grains or the egg) can be induced to develop into embryos or callus. These embryos or callus cells will be haploid in nature and it is possible to double their chromosome number through application of colchicine and obtain isozygous diploid lines. These diploid plants of gametic origin can be excellent materials because these can be used as purelines in plant breeding programmes. The production of purelines through anther and pollen culture can be possible within three to four months time. On the other hand, the production of purelines through conventional methods of repeated inbreeding and selection may take years.

(E) Embryo Rescue:

In case of inter-specific crosses, the hybrid seeds are often greatly shrivelled, very light, and incapable of germination. Since such seeds are non-viable, the embryos abort quickly. It is possible to excise the embryos from hybrid seeds and grow successfully in a vitro conditions. This is called as 'Embryo Rescue'. This has tremendous application in plant breeding. The possibility of growing embryos outside the environment of the ovule (ex-ovulo) provides an excellent opportunity to study the nutrition of the embryo at various stages of development.

Embryo culture techniques have been successfully applied to orchid seed germination. The tiny orchid seeds have very small endosperm which can hardly support germination of the embryos. That is why most of the orchid seeds are lost in nature. These seeds can be grown on synthetic nutrient medium in vitro without fail.

(F) Protoplast culture, somatic hybridisation and genetic manipulation:

Protoplast is a plant cell from which the entire cell wall is removed. Protoplasts can be obtained either mechanically, or more easily by enzymatic degradation of the cell walls. Protoplasts when cultured regenerate their cell walls. Protoplasts in culture can be induced to regenerate into entire plants, to undergo intra- as well as inter-specific fusions to form somatic hybrids, and to make up foreign genetic materials. Protoplast culture techniques are especially important because of their application in efforts to

improve plant species by cell modification and somatic hybridisation. Protoplast system can be employed to investigate problems in plant physiology, virology, pathology and cytogenetics. In future, protoplast culture is likely to be one of the most frequently used research tools for tissue culture studies and may have unlimited potential in genetic engineering for plant improvement.

(G) Somaclonal variation, Induction and selection of mutants:-

'Somaclones', as has been pointed out earlier, are plants derived from any form of cell culture, involving the use of somatic cells, 'somaclonal variation' is the phenotypic variation, which may either be genetic or epigenetic in origin, displayed among the somaclones. Somaclonal variants arise spontaneously in culture conditions. These variants sometimes exhibit novel characteristics and can be highly useful. One of the major draw backs of mutation breeding in higher plants is the formation of chimeras. When seeds, organs or the whole plant is subjected to mutagenic treatements chimeras are often produced. In this regard cell culture methods of induction and selection of mutants are more efficient. Suspension cultures (containing either haploid cells or somatic cells) provide a microbial like system for induction and selection of mutants which has the advantage of handling millions of potential plants in a minimal space. Mutant cell lines can be selected for disease resistance, herbicide resistance, environmental stress tolerance etc. which will have tremendous applications in agriculture.

4. Cell suspension culture:

Suspension culture is a type of culture in which free cells, or aggregates of cells, multiply while suspended-in liquid nutrient medium. A number of culture vessels have been designed to grow large scale cultures under steady state for long periods by adding fresh medium and draining out the used medium. In such systems all the culture parameters are automatically controlled through electronic gadgets. Suspension culture techniques can be of considerable importance as these can be employed for industrial production of a host of compounds such as amino acids, proteins, sugar derivatives, drugs, alkaloids, sterroids, rubber, oils, etc.

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FOOD PRODUCTION

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RCE, Bhubaneswar.

Food is the basic need of man. Survival depends on its production levels. The major food crops of India are Rice and wheat.

Rice Cultivation: Oryia sativa x = 12 -- Poaceae

Food grains production declined by 13 million tonnes in 1987-88 from the 1985-86 level, many felt that food production was still a gamble with monsoons and there was fear that Rice production would continue to be stagnant. Hence, the dramatic spurt in food-grains out put during 1988-89 by 34-35 million tonnes over 1987-88 came as a big relief reviving confidence in the resilience of the farm sector.

The sharp increase in production has been mainly on account of Cereals and particularly rice, where the incremental output was 1403 million tonnes. Andhra Pradesh and West Bengal showed sharp increases, each producing a record 10.2 million tonnes.

Special thrust programme:

For the first time, a comprehensive programme was launched in rice, particularly in non-problem areas, with the focus on the strengths and weaknesses of different regions. The special thrust programme covered 108 districts where irrigation and drainage system are amenable to management. Consequently a multipronged stimulus covering major in puts such

as seeds,

- Fertilizers - Storage - cold [illegible]
- Pesticides [illegible]
- Credit

There was an impressive increase in "Kharif" rice - production - 15.08 million tonnes. While there was modest drop in "Rabi" output by 1.35 million tonnes. The Kharif output was 63.84 million tonnes.

It is becoming clear that rice is responsive to specific stimuli, despite organisational short-comings and stiff competition from commercial crops.

The increased production, particularly during the dry season came from higher productivity and a larger area in West Bengal, Andhra Pradesh, Bihar, Tamil Nadu.

Kharif production was also much higher in West Bengal, Andhra Pradesh, Eastern Uttar Pradesh, Eastern Madhya Pradesh.

On the whole, West Bengal, Andhra Pradesh, and Tamilnadu exceeded their targets by 1.4, 1.9 and 0.35 million tonnes respectively. While Bihar, Maharastra and Uttar Pradesh showed marginal increases. Assam, Gujarat, Orissa, Haryana, and Punjab could not achieve their targets, while, Karnataka just met the target.

The increase in production in the states, where the special thrust programme was implemented ranged from 40,000 tonnes to 1.9 million tonnes.

In productivity however important states like Assam, Bihar, Gujarat, Madhya Pradesh, Maharastra, Orissa and Uttar Pradesh have not yet reached the national average of 1650 Kg/ha in 1988-89. Only

West Bengal has maintained this level for the last two years. The Indian average is even now below the world average of 2,143 Kg/ha and the Asian average of 2,193 Km/ha.

Favourable Factors:

Among the important factors governing rice production, cultural skills and inputs from one set, and farm credit, farmers, enthusiasm and profits the other, while weather is a third major influence. In 1988-89 fertilizer consumption increased impressively although states such as Assam, Orissa, Madhya Pradesh, Bihar, Nagaland, Sikkim, Tripura, Meghalaya and Maharastra were below the national average. The cropped area also rare to a round 42 million hectares.

Another important factor in farm husbandry is timely planting unusually during 1988-89, the monsoon gave a big boost for the production rise. Consequently there was bright sunshine during October and November, during the reproductive phase of the crop which promotes photosynthesis and enhances output per unit input. Moreover, fertilizer use has greater stimulatory effect under bright shunshine conditions, while pest and disease have minimal impac t.

It is a well- cordinated exercise. The special thrust programme (STP) which involves crores of rupees and vast manpower with emphasis on cardinal principles of "timeliness" nutrient management.

Guidelines for enhanced production:

To meet the challenging climatic situation one must follow the following principles as guidelines for enhanced production.

a) Land, water, energy, and cost saving crop - husbandry that is, productivity advance and water use energy use efficiency become the major pathways for enhanced production.

b) Grain savings and storage is also one of the most important aspects of Grain production.

c) Watershed management.

d) Gustainable management of basic agricultural assets of land, water, flora, fauna, and the atmosphere and in general the bio-sphere, for this purpose is a new approach for obtaining the enhanced production or Eco-friendly approach.

$$\text{Productivity} = \frac{\text{Output value}}{\text{Input value}} + \text{Change in environmental capital stocks.}$$

e) Employment oriented agricultural based Research and development lead to the better job potential and it catters the need of the rural youth in a better way.

Water Management:

In the crop-production the water - shed management is the critical part. Conservation and sustainable management of water resources. It will be appropriate to express yield in terms of units of water consumed rather than only in terms of land used.

Area and productivity of Principal field crops of coastal plains (Triennium 1982-85)

East coast

Crop	Area	Productivity (Area lakh ha,
Rice	56.29	1,734 Kg/ha
Pulses	8.38	4116
Groundnut	7.78	1,195
Jowar	3.37	709
Bajara	3.44	922
Ragi	2.69	1,078

Wheat Cultivation:

Wheat with a record production of over 54.14 million tonnes, as estimated by the Union Ministry of Agriculture. There has been a quantum jump of more than 9 million tonnes in wheat production over the previous years record. The annual production during 1989 is 2.353 tonnes a hectare.

Wheat is an important rabi crop in the country. Wheat is grown in over 23 million hectares, about half the total area under food crop production. Wheat is a major crop in Uttar Pradesh, Madhya Pradesh, Punjab, Bihar, Rajasthan, Haryana, and Maharastra alongwith .

1. Favourable Factors: The substantial increase in production this year is attributed to the beneficial winter rain and introduction of (SFPP) Special Food grains Production Programmes in 71 identified districts in the Northern states.

SFPP was launched in the States of Bihar, Gujarat, Haryana, Madhya Pradesh, Punjab, Rajasthan and Uttar Pradesh.

The HYV's are used in boosting the production

Sonalika (R.R 21)	Kalyansona -
Jawahar -	Janak H.D 10.7 -
Ganga hybrid -	Pusa lum
U.P. 301 -	Clufi lum
Arjun H.D. 2009	

2. Chemical contents of Rice grain:

60 - 80

8 - 15% Prot.

2% Fat

1.5 - 2%

Vitamin B, C and large number of amino acids.

Essential Nutrients Required for Development of plants

Macro-nutrients	Carbon Hydrogen Oxygen	Nitrogen Phosphorus Potassium	Calcium Magnesium Sulphur
Micro-nutrients	Iron Manganese Copper	Zinc Boron Molybdenum	Chlorine - -

Land Resources not used for cultivation in India.

Type of land.	Area(in million hectare)	Condition	What do you think should be done.
Cultivable	87	Affected by erosion	-
Forest pasture	48	Without tree cover	-
Waste/fallow	40	Not used	-
Flood affected	40	-	-

Consumption of Fertilizers in India.

Year	Fertilizer Consumption in India (Total in lakh tonnes)
1950-51	0.09 - 0.69
1970-71	21.77 - 19.13
1985-86	90.00 - 46.00

Common Weeds: Chenopodium, Amaranthus, Convoluulus, wild oat.

Hybridization: The process of cross-breeding is known as Hybridisation. In the Hybridization desired characters of plant are obtained by clonal selection or bulk selection method.

Hybridization yields(HYV) - High Yielding varieties

Important insect pests: Paddy stem borer - Tryporyza oncertulas

Paddy cut worm - Cirphis unipunctata

Paddy bug - Leptocorisia Varicornis

Cattar pillar - Spodoptera mauritia

Common Pests and Diseases:

Paddy blast | Puccinia Oryzial

Yellowrust |

Hillbunt - Tilletia foetida

Black Smut of Rice - Ustilago oryziae

The common Dithane, Zineb, Endosulphass, BHC powder Agrosan, are commonly used to control the diseases.

Hyysin crop production and Bio-technology for conservation of germplasm.

Wheat - Lerma, Rajo 64A, Sonara-64, Sharabathi, Sonara, Pusa, Lerma, Sonalika, Kalyansona, Hira, Motiarjun.

Paddy(Rice) - Jaya, Padma, IR-8, T-141, [illegible],

Pusa-4-1-11 - ICAR, Vijaya - IR-[illegible],

Pankaj, Jagannath, Ratna.

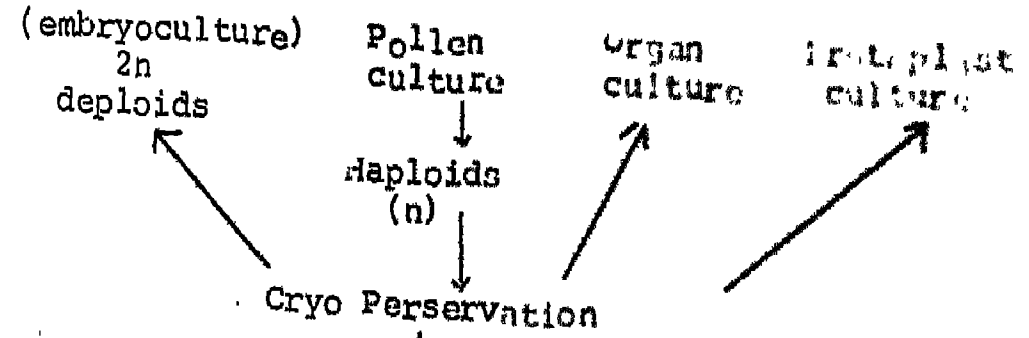
Maize - Ganga-101, Ranjit,

Deccan hybrid -

Bio-technology of germplasm conservation:-

- Germplasm conservation is done in Gene Banks.
- Germplasm bank (Gene bank)
- Germplasm storage

Tissue Culture



Liquid nitrogen at 196°C

tissues are freeze preserved

To safeguard the tissues from freezing certain cryoprotects are also used like

DMSO Dimethyl sulfoxide

Freeze Preservation

Germplasm. Conservation.

PRACTICALS

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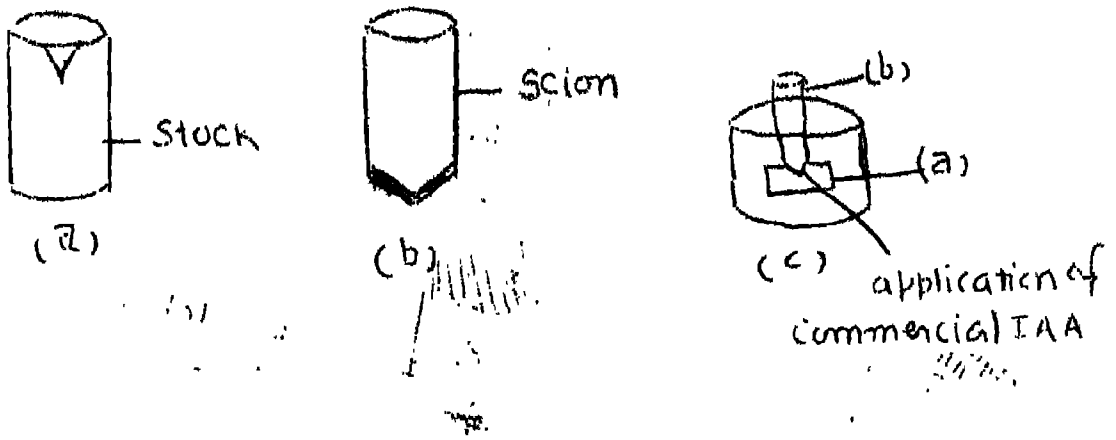
Grafting:

Plants organs are generally subjected to various wounds due to different factors such woulds result in the exposure of living tissues, lying beneath the wound. These wounds are healed in various ways of which secondary growth and cambial activity take the main part in wound, healing phenomena and formation of the union during grafting.

In case of grafting callus tissue formation takes place from cambia of two compatible shoots, referred as stock and scion: This callus tissue fill up the space between the two.

Grafting Procedure:



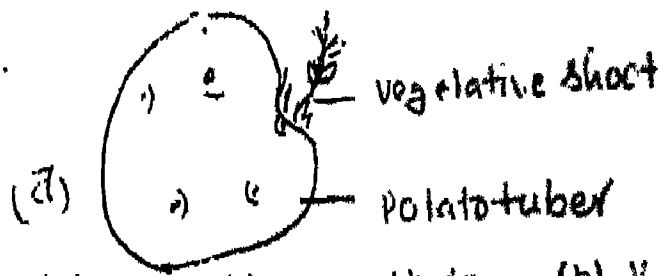
Depending on the quality and softness of the wood.

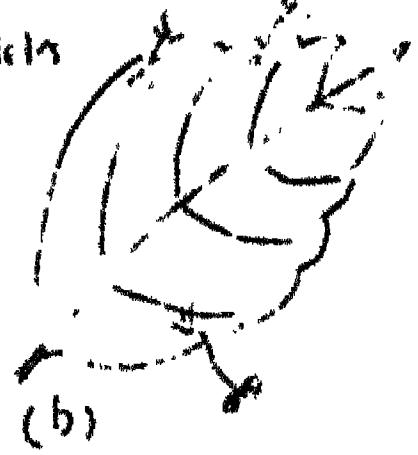
IAA= Indole Acetic Acid growth regulator (Promotor)

The IAA should be applied in different strengths for that IAA + water should be made as a paste or directly the shoot should be dipped in the solution and a thin

polythene cover along with wet soil is to be applied. So that after some days the grafting is perfect, the wounds is leveled, sometimes root initiation also comes.

Vegetative Propagation:

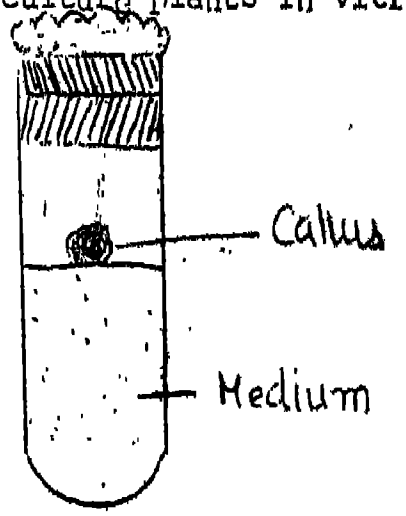


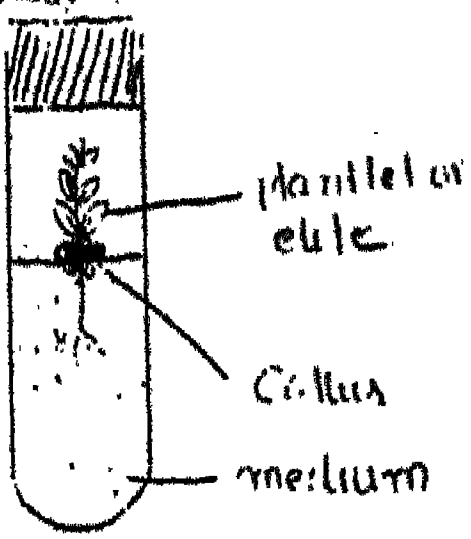


(a) Vegetative growth in potato.

(b) Vegetative regeneration in Bryophyllum leaf.

In normal moisture, and with little sunlight, the pototuber shows, vegetative growth is common example to express this phenomenon. This is also seen in Bryophyllum lent too. The modern method to have the tissue-culture or callus culture from any part of the plant in artificial-medium- M.S. Medium we can culture plants in vitro-method.





PHOTOSYNTHESIS

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Photosynthesis on earth is carried out by plants. Plant manufacture their complex organic food from simple materials such as water, carbondioxide, a large amount of energy is required for the synthesis of food material. The main source of energy is sunlight. The green pigment chlorophyll plays an important role for the capturing of the light energy.

The green plants utilise carbon dioxide as a raw material and liberate oxygen as a by-product. In this way this process is very important for the equilibrium of carbon dioxide and oxygen inatmosphere. This process is not very simple before the forma ion of end product various intermediary compounds are formed.

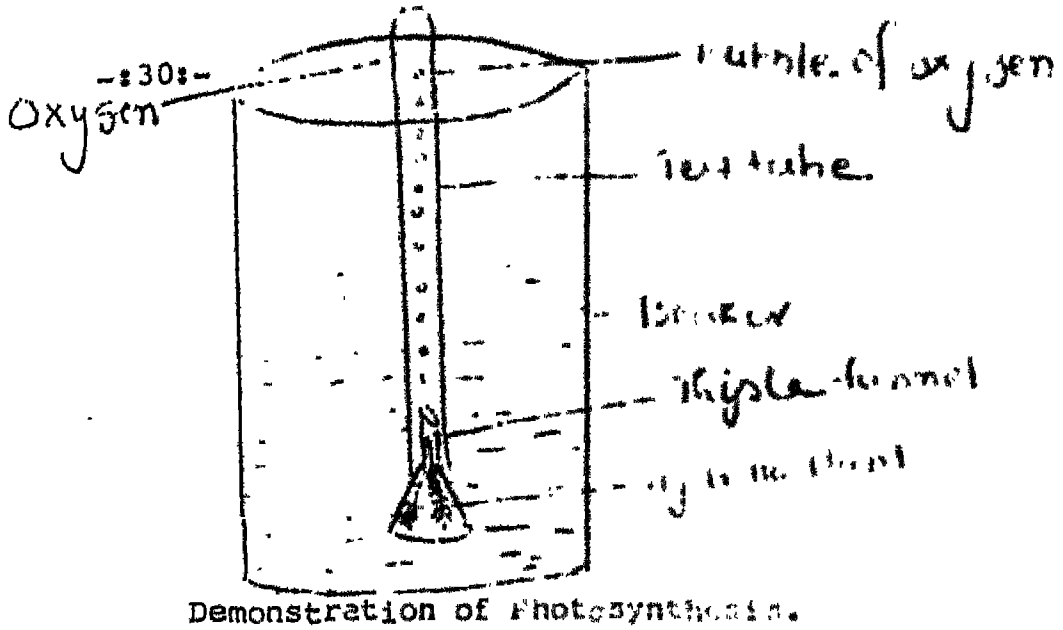
Thus the process of photosynthesis can be defixed as follows: The formation of organic food material in the illuminated chloroplast from the water and carbon dioxide with liberation of oxygen. The whole process can be summerised as follows:

$$6Co_2 + 12H_2O \xrightarrow[686\ K\ Cal\ light]{Chloroplast} (6H_{12}\ 06 + 60_2 + 6\ H\ Co$$

Objective:

To demonstrate that oxygen is liberated in the process of photosynthesis.

Requirement: Hydrilla plant, Beaker, Test tube, a funnel, water and pond water.



Demonstration of Photosynthesis.

Experimental Procedure:

Few twigs of Hydrilla plant are kept under inverted funnel in a beaker filled with water. The cut ends of the plant should face the tube of funnel. A test tube filled with water is placed upside down over the tube of the funnel partially dipped in the water of the beaker.

After sometime the air bubbles begin coming out from the cut ends. The air bubbles are collected at the top of the test tube. When enough quantity of gas is collected the pyrogallol (Pyrogallic acid) is introduced into the test tube which absorbs oxygen immediately and the test tube gets refilled with water again. The absorption of gas by Pyrogallet indicates that the oxygen is liberated during photosynthesis as can be explained by the following equation:

$$6\ Co_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{light}} C_6H_{12}O_6 + 6\ H_2O + 6O_2$$

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TISSUE CULTURE

Dr.G.V.Gopal,
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Tissue culture is a general term th t is concerned with the study of not only tissues, but also of cells. "Protoplasts" and "organs" maintained or grown invitro. Invitro technique (meaning literally in a glass) is relatively a new branch of Biological Science, is based on the concept of Totipotency of living cells" a theory proposed by G.Haberlandtin 1902.

Totipotency: Totipotency may be defined as the inherent capacity of a living cell to regenerate into a whole organism and is derived from the fact that as each cell of an organism is derived from the fertilized egg. It must possess the inherent capacity to devide and give rise to the whole organism. F.C. Steward and his Co-workers, demonstrated that Cellular - totipotency is a remarkable phenomenon which helps in the process organogensis. And thus Carrot root cells in a nutrient medium supplemented with coconut milk were developed in plantlets. This tissue culture technique is employed to propogate such plants at a faster rate, where, seed are not there, and where growth patters are very slow, where physiological dormency plays a vital role in germination. Plant growth can be broadly classified into two kinds. They are:

(i) Organised growth: (ii) unorganised growth. In practice Callus is first developed from which cell

What is "Callus" ? Callus is cell aggregates which arise from disorganised growth of small plant organs or detached plant tissue or previously cultured cells.

Tissue Culture:

The maintenance of growth of tissues invitro, in a way that may allow differentiation and preservation of their architecture and or function.

Sub-Culture:

Aseptic transfer of a part of a culture to a fresh medium is called as sub-culture.

Medium:

Preparation of 'HS' Medium:

(i) Micro nutrients (100 x)

$Mn\ So.\ 4H_2$	-	2230 mg	Dissolved serially in 1000 ml double distilled water label stock-'A'
Or Mn. So. anhydrous	-	1690 mg	
$In\ So_4 . 7H_2O$	-	860 mg	
$H_3\ Bo_3$	-	620 mg	
K 1	-	83 mg	
$Na_2\ Ho\ O_4\ 2H_2O$	-	25 mg	
$CuSo_4\ 5H_2O$	-	205 mg	
$Co\ Cl_2 . 6\ H_2O$	-	2.5 mg	

(ii) Iron/EDTA (200 x

$Feso_4 . 7H_2O$	-	557 mg.	Dissolve separately in double distilled water, mix up the two & make up the volume to 100 ml.
Na EDTA $2H_2O$	-	747 mg	

Label stock 'B'

(iii) Vitamins (100 x)

Glycine - 200 mg Nicotinic acid- 50mg Pyridoxin-HCL- 50mg Thiamin-HCL - 10mg Myo - Inositol-10,000mg.	Dissolve in 100 mg sterile double distilled water. Label stock - C

Preparation of 1 litre of 'MS' Medium

1. Weigh out the following and add directly to a 2 litre flask.

$K\ No_3$	- 1900 mg
NH_4No_3	- 1650 mg
$Cacl_2\ 2H_2O$	- 440 mg
Or $CaCl_2$ anhydrous	- (332.2 mg)
$Mg\ So_4\ 7H_2O$	- 370 mg
$MgSo_4$ anhydrous	- 180.7 mg
$KH_2\ PO_4$	- 170 mg

2. Dissolve the above in approximately 500ml of double distilled water.
3. Add 10ml micronutrient solution from stock 'A'.
4. Add 5ml Iron/EDTA from stock -'B'.
5. Add cytokinin (Kinetin, BAP etc.) and auxins (IAA, NAA, IBA etc. as required (mg/1). For hybrid rose-materials, you can take only benzyl adenine (BA) at a concentration of 0.5 mg .
6. Add 30 gms of Sucrose and dissolve.
7. Bring the final volume to 1000ml by adding double distilled water.
8. Adjust PH of the nutrient solution to 5.7 $\pm$ 0.1 with 0.1N NaOH or 0.1N OH using a pH meter you can also adjust the pH with the help of pH paper strips.

9. Add 8g of Agar-Agar to the 1000ml nutrient solution and gently warm and dissolve the agar. Close the cotton plug. Seal with aluminium foil.

10. Autoclave at 121°C and 1.05 Kg/Cm^2 pressure for 20 minutes. Alternatively you may sterilize with the help of a large pressure cooker. After the first whistele, continue heating for 20 minutes.

11. Transfer the flask with autoclaved medium to sterile transfer hood. Cool down to about 50°C. Now add 2 ml of filter-sterilized vitamin solution from Stock-C and mix gently.

12. Dispense the warm 50°C solution into sterile culture tubes under "a-septic condition for keeping aseptic conditions one should have a laminar flow-chamber in the laboratory.

Preparation of tissue:

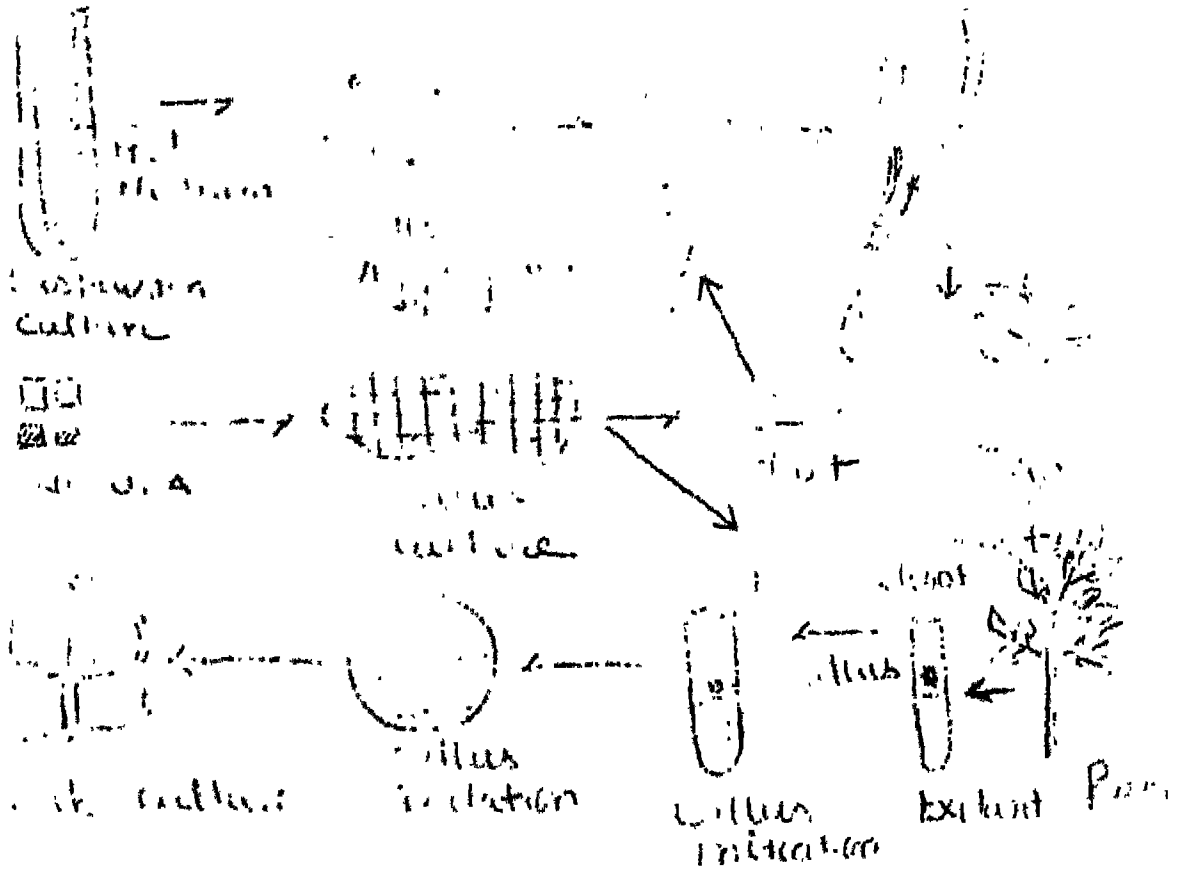
(1) A healthy plant / organ.
(2) Few drops of wetting agent like "Teepol"
(3) 7.1 V/V mercuric chloride solution.
(4) 2 x 450 ml bottles of sterile distilled water.
(5) Pre-sterilized beaker (250ml) - 2 nos.
(6) A twig cutter.

Prepara tion:

Cut the plant part which is to be used for tissue-culturing and soak it in mercuric chloride solution. which makes the maturite, surface steriliza-tion and transfer the material after washing it with distilled water to culture flask with Ms. medium under aseptic condition. Later keep the flask in constant

temperature flax in artificial light, or we can keep them in incubator for 3 days. Afterwards keep the flasks in culture room. After observing the flasks if it has contamination discard them, only heating flask are to be kept in the culture room.

TREE REGENARATION FROM SOMATIC CALLUS;



"MS" Medium = Murashige and Skoog, (1962) medium.

Explant = exised fragment of plant tissue or organ used to start tissue culture.

Sub-culture = Aseptic transfer of part of a culture (Inoculum) to a fresh medium:Passage.

STRUCTURE OF ATOM

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Introduction:

Chemistry is a branch of science which deals with varieties of matter. Dalton's Atomic Theory was the first and very important theory, which looked as if the last word on structure of matter. According to this theory, atoms of one kind behave differently when compared to the others and hence account for the difference in their respective properties. For example, sodium is kept in kerosene and in fact cannot be kept in water whereas phosphorous is preserved under water. The difference in the colour of the glow of neon signs and fluorescent tubes is another example. Why do atoms of different kind behave differently? The answer to this question comes from the study of structure of atom.

Some significant discoveries in physical sciences were made towards the end of the last century. These were the study of the phenomena of i) discharge of electricity through gases, ii) scattering of alpha particles by metal foils, iii) radiation emitted by atoms, iv) wave-particle dualism, and v) uncertainity principle. These milestones in experiment and theory give us the structure of atom as we understand it today. Now we list the objectives of teaching structure of atom at secondary level.

Objectives:

Pupils are expected to be able to:

1) list fundamental particles present in an atom,
2) differentiate between these particles,

3) describe various models of atom and discuss their respective validity in relation to the experimental observations,

4) interpret spectra in terms of transfer of electron from one energy state to another,

5) define Heisenberg's uncertainity principle,

6) explain the introduction of four quantum numbers to define the energy state of an electron in an atom, and

7) draw schematic diagram for the filling up of electrons as per their energy levels.

Fulfilment of these objectives needs a good comprehension of the related concepts which may be shortlisted as follows.

Concepts:

1) Atoms (and hence the matter) are electrical in nature.

2) Like matter electricity is also particulate in nature, that is electric discharge takes place in discrete units.

3) Atom is composed of electrons, protons and neutrons.

4) Arrangement of electrons, protons and neutrons in an atom is explained by a number of models such as Thomson and Rutherford models. Out of these the latter model is currently accepted as most satisfying on the basis of the experimental data. According to this model protons and neutrons are situated in a very small volume compared to the size of the atom and constitute so called the nucleus of the atom, and electrons are in motion around the nucleus and fill most of the space of the atom.

5) Radiant energy 'E' is emitted or absorbed, not continuously but in discrete units called quanta defined by $E=h\nu$ where 'h' is the famous Planck's constant and 'ν' is the frequency of the radiation.

6) The radiant energy in the form of spectral lines is emitted as a consequence of transference of electrons from higher energy level to lower energy level.

7) Electrons (as well as matter) exhibit both wave and particle nature symbolised by the de Broglie relationship $\lambda = h/p$ where 'h' is again the Planck's constant, 'p' is the momentum of the particle, and 'λ' is the wavelength of the wave associated with the particle.

8) It is impossible to simultaneously (at the same time) determine both the position and momentum of an electron exac-tly or with equal degree of accuracy.

9) The region around the nucleus, where there is maximum probability of finding the electron is called an orbital and the wave function of an electron defines an orbital.

10) An electron in an atom may be completely described by a set of four quantum numbers.

11) No two electrons in an atom have the same set of all the four quantum numbers (Pauli Exclusion Principle).

12) Electrons are filled in various orbitals in order of increasing energy.

The Strategy:

Development of the above listed concepts by the teacher in the classroom situation is no doubt a difficult task as it is difficult to pick up examples for this topic from the environment or from the real life. However, there are some activities which can be carried out in the class with simple items/apparatus so as to create sufficient motivation among the pupils so that they develop certain concepts on atom which Mahatma Gandhi Compared with 'Atma'. One thing is certain in this regard that the teacher should have sufficient mastery over this content. Then only he can venture to explain these concepts to pupils and achieve the listed objectives. For this a plan consisting of the following sequential steps is suggested.

STEP. 1: Recall and test the previous knowledge prerequisite for the new topic. This forms the foundation of the strategy.

STEP. 2: Introduce the topic, as intimately as possible, stressing its importance in respect of its application in daily life; inviting the experience of the pupils and thus taking into account their alternative concepts.

STEP. 3: Develop the concepts in the sequence listed earlier using as far as possible the following approaches, methods and skills.

Approach - Learner-centered and Logical; Methods-Inductive-deductive and Lecture-cum-demonstration; Skills-Listing of relevant examples and generating curiosity. A judicious combination of approach method and skills defines a particular strategy of teaching this topic.

STEP.4: For a given lesson and also at the end of the teaching of this topic all the concepts should be summarised by asking questions to the pupils.

STEP.5: Suitable home assignment should be given to the students to practise the acquired knowledge and to further enrich it.

A brief exemplar for the Step 3 is suggested as follows.

A balloon filled with air when rubbed slowly and carefully on a synthetic fibre-shirt and then brought near the wall; will be attracted by the wall. Two such balloons when suspended with the help of a

thread can be seen to repel each other slightly. It is also observed that while taking out a terylene or polyster shirt from the body the hair of the body point away from the body and if we are careful we can hear or in the darkness can even see the sparks passing between the hair and the shirt. The plastic comb or for that matter any plastic object when rubbed by another surface, attracts small bits of paper. When we comb our dry hair by a comb they stand apart due to mutual repulsion. If we take dry mustard seeds on a plastic plate and just rub them gently on the plate we can see them move violently away from each other. Such observations show that matter is electrical in nature. While citing such examples we should see that some of them come from the pupils as well. Also if we stick to prototype examples of glass and ebonite rods and catskin and silk pupils may develop a wrong concept that only these substances have electrical nature.

On the basis of above examples and citing the study of the electric discharge through gases we should try to convince the pupils logically about the electrical nature of matter and also of the fact that atom is electrically neutral but contains very light negatively charged particles called electrons. Further it can be said that following three models could be thought of to describe the atom.

(a)	(b)	(c)
Positive charge at the centre	negative charge at the centre	uniform distribution of +ve and -ve charge

At this stage, Rutherford's observations on scattering of alpha particles may be recalled as follows:

1) Most of the positively charged alpha particles pass through the thin gold foil undeflected,

2) some of these are deflected at large angles, and

3) a very few of them rebound back along their initial path at 180 degrees. Now discussions can be held on each of the three models. This discussion would lead logically to the following conclusions.

i) Since most of the alpha particles pass through the foil undeflected, it looks as if the atom is mostly empty space.

ii) Since a very few alpha particles are scattered through very large angles the positively charged part of the atom should occupy a very small volume of the entire atom.

iii) A deflection through 180 degrees indicates that there is an intense electric field inside the atom. Since a positive charge spread over the whole of atom will be incapable of producing such a field so it is concluded that the positive charge is concentrated in a very small volume at the centre of the atom. This central positively charged massive body of the atom is known as its nucleus and electrons revolve around the nucleus in empty space. Similar exemplars to develop other concepts may be thought of and evolved which in most of the cases be based on logical approach and can be made more helpful for transacting the curriculum in

STUDY OF HYDROCARBONS - ORGANIC CHEMISTRY

Introduction:

The term 'Organic' was introduced by Swedish Chemist Berzelius to define chemicals that were obtained from living sources (Plant or animal) rather than from non-living or laboratory reactions. This accepted doctrine then was that organic compounds could only be produced by the operation of 'Vital force' inherent in living cells and hence could not be formed artificially. However, in 1828, the German Chemist F.Wohler prepared an organic compound, Urea, in his labora-tory by heating an inorganic compound, ammonium cyanate. This reaction disproved the idea of 'Vital force' theory. Now millions of organic compounds known to occur innatural plants and animals have been prepared in the laboratory by able research workers. There is no limit of possibility to synthesise more and more organic compounds.

Meaning: Now-a-days organic compounds are defined as hydrocarbons and their derivatives without reference to their sources. The branch of chemistry that deals with the study of such carbon compounds is known as organic chemistry.

Importance: The study of organic compounds is important because these are present in a variety of substances we come ac-ross in our daily life; e.g.(a) in our food (cereals, pulses, fruits, vegetables, milk, sugar, tea, fish, meat, egg etc.), (b) in clothing (cotton, nylon, wool, silk, polyster etc.), (c) in paper and ink,

(d) in common fuels (petroleum products like petrol, diesel, kerosene and cooking gases, candle wax, fire wood etc.) in drugs and medicines (antiseptics, antibiotics, anti-malarials, anaesthetics, vitamins etc.) (f) in cleaning agents (soaps and detergents), (g) in cosmetics (snow, vanishing creams, talcum powders, shampoo, nail-polish, lip-sticks, perfumes etc.) (h) and in most other important substances like plastics, rubber, polishes etc. Therefore, the study of organic compounds is essential to understand the various aspects related to life-situations and processes in nature and in industries.

Scope of this presentation:

In this paper, an attempt is made to present a conceptual frame-work of the nature of organic compounds, with particular reference to the unique nature of carbon in forming a large number of compounds grouped into different series, their systematic naming, functional group, their classification and isomerism along with the related learning objectives.

Concepts:

(1) Organic compounds are compounds of carbon except its oxides, sulphides, carbides and carbonates and bicarbonates.

(2) Carbon has the unique property of interlinking with its own atoms giving rise to a large number and variety of organic compounds. This property of carbon is known as "Catenation".

(3) Hydrocarbons (i.e. compounds composed of carbon and hydrogen only) are parent organic compounds.

(4) The phenomenon of two or more compounds having the same molecular formula, but different structural formula is called 'isomerism'.

(5) A functional group (i.e. an atom or a group of atoms forming the active part of the molecule) is mainly responsible for the chemical properties of a particular family of organic compounds.

(6) Organic compounds can be classified on the basis of functional groups.

(7) A family of organic compounds having the same general formula in which each member differs from its preceding or succeeding member by a $-CH_2-$ group is known as a 'homologous series' and exhibit certain common trends.

(8) A set of rules for systematically naming organic compounds i.e. Nomenclature, has been devised by the International Union of Pure and Applied Chemists (IUPAC).

Learning Objectives:

(1) To understand the meaning and importance of organic compounds and organic chemistry.

(2) To define and classify hydrocarbons.

(3) To differentiate saturated hydrocarbons from unsaturated hydrocarbons.

(4) To write the molecular and structural formula of homologues of alkanes, alkenes, and alkynes.

(5) To differentiate between molecular, structural and condensed structural formula of organic compounds.

(6) To understand the reasons for the existence of a large number of organic compounds. (i.e. Catenation and isomerism in case of hydrocarbons).

(7) To define the functional groups.

(8) To study the relations between properties and structures of the organic compounds. (in case of hydrocarbons)

(9) To write the systematic names of organic compounds (alkanes, alkenes and alkynes). and

(10) To realise the day-to-day applications of organic compounds.

Skills: (1) Skill of classifying given objects made up of organic materials into different groups of substances.

(2) Skill of writing correct names and structural formula of organic compounds according to IUPAC system.

(3) Skill of predicting the properties of organic compounds on the basis of a functional groups.

(4) Skill of writing balanced equations for various reaction of hydrocarbonds.

Development:

The lesson can be appropriately introduced by starting with a brief survey of the sources from which organic compounds originate (i.e. coal and petroleum). Every year thousands of new organic compounds are synthesised and many of those previously obtained from animals or plants can now be prepared in the laboratory and on a large scale in industry.

The lesson can be developed by discussion supported by suitable demonstration selected from the school as well as family environment and by assigning simple individual as well as group activities to the students.

Sample test-items:

(1) Select the organic compounds from the list of wick, asbestos, glass, cement, ribbon, gum, starch, pencil lead, spirit, kerosene.

(2) Classify these compounds as alkanes, alkenes and alkynes: C_2H_4, C_2H_6, C_3H_8, C_4H_6, C_3H_6, C_2H_2.

(3) Select the homologues from the following and group them under different headings. CH_4, C_2H_4, C_2H_6, C_3H_6, C_2H_5-cl, C_3H_8, C_3H_8, C_3H_7-cl, C_2H_2

(4) Write the IUPAC names of the following:

(i) $CH_3 - CH_2 - CH_2 - CH_3$

(ii) $CH_3 - CH = CH - CH_2 - CH_3$

(iii) $CH_3 - C \equiv C - CH_2 - CH_3$

(5) Write the structural formula and IUPAC names of all possible structural isomers of C_6H_{14}.

(6) Fill up the blanks with appropriate terms.

(a) Organic compounds having the general formula $C_n H_{2n-2}$ are known as _____.

(b) Organic compounds having the same molecular formula but possessing different properties are known as _____.

(c) Organic compounds having the same general formula in which each member differ from its preceding or succeeding member by a $-CH_2-$ group are known as _____.

(d) Organic compounds, known as alkenes, will have the general formula _____.

Key to Q-6. (a) alkynes, (b) isomers, (c) homologues, (d) $C_n H_{2n}$.

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METALS AND NON-METALS

General: Of the hundred and odd elements known more than eighty are metals. Each element has its own characteristics, Metals as a set of elements, have some general characteristics which differentiate them from rest of the elements (i.e. nonmentals). Although it is not that easy to draw a sharp line of distinction between a metal and a non-metal, a few prominent properties (both physical and chemical) can distinguish them from each other. A few border-line elements are known as metalloids (e.g. As, Sb, Bi).

CONCEPTS:

1) Elements can be broadly classified into metals and non-metals; a few being metalloids.

2) The observed physical properties of metals can be explained on the basis of metallic bonds.

3) The chemical properties of metals are different from those of non-metals and the relative reactivity of metals can be explained taking help of the electrochemical series (metal activity series).

4) Methods of extraction of metals depend upon the nature of their ores.

5) Metals and alloys find many uses in our daily life. A study of the periodic table indicates that in any one horizontal row, there is almost a regular change from metallic to non-metallic character from the left to the right. Similarly within line vertical column,

there is regular change from non-metallic character of elements to metallic character as we go down from top to bottom.

General Characteristics of Elements: (metals)

Although the metals show a great diversity of properties, there are some general characteristics which distinguish them from the non-metals;

1. PHYSICAL PROPERTIES

a) They are good electrical conductors

b) They are good thermal conductors.

c) They have lustre on freshly cut/broken surface

d) They have closed packed arrangements of atoms and therefore tend to have relatively high densities.

e) They change shape without cracking, under strain and so are malleable and ductile, in spite of the fact that their atoms hold strongly to one another. (f) They possess high m.p. & b.p.

The above observed physical properties of metals cannot be explained on the basis of covalent and ionic bond models.

Let us examine the structure of metallic atoms.

i) They have a few valence electrons and a number of vacant orbitals.

ii) They have low ionization energies.

When atoms of a metallic element are brought together they readily lose one or more valence electrons which can freely move into vacant valence orbitals of neighbouring atoms. On a collection of atoms, we can imagine the atoms are +vely ionized which are submerged in a sea of electrons. This model is known as Metallic bond.

Let us now see how the metallic bond model may be used to explain the physical properties of metals.

(a) & (b) THERMAL AND ELECTRICAL CONDUCTIVITY

On heating an iron rod at one end, the atoms gain energy and vibrate rapidly. Consequently, the electrons also move about with more energy within the crystal lattice of the metal. Some of this energy can be rapidly transported to the end of the rod. During conduction of electricity through a metal (copper wire), the mobile or delocalized electron shifts from one atom to another on account of its freedom to move.

(c) LUSTURE AND COLOUR:

Finely divided metals appear to be brown or black. Presence of metallic bond gives this property. The incident light (considered as a form of energy) increases the kinetic energy of the delocalized electron which is passed on to kernel of the atom, which in turn moves more rapidly, but at random. This results in the absorption of light of all wave lengths and causes the black appearance of the metal. In polished surfaces of the metals, the light is absorbed and emitted with change in direction. The metals in general appear to be silvery grey. (d) & (e) HARDNESS, MALLEABILITY & DUCTILITY.

As stated earlier, the structure of metallic crystals suggest that in such a crystal, there is a sea of delocalized electrons and that the positively charged metal ions are clustered in it. When a metal is stretched or beaten, the ions move in the direction of the force applied and the metal changes its shape to a wire or a sheet, without breaking. During this

arrangement, the vacant places or imperfections in the crystal structure are removed and the metal becomes harder, while bending a metal wire or sheet, ions are separated from the adjacent delocalized electrons and nearest ion neighbours to disturb or break the crystal pattern. Even though these break in, the pattern may not be visible as cracks, yet they represent regions of irregular joining of crystals.

No further attempt can put these crystals into original shape and form because the planes and edges formed during bending do not fit in again to form the original crystal pattern.

(f) MELTING AND BOILING POINT:

Sodium is a soft metal and its m.p.& b.p are relatively low where as magnesium and aluminium are hard and of higher m.p. & b.p. This can also be explained on the basis of metallic bond model. The bond between two sodium atoms in a sodium crystal is only one eighth of a covalent bond because the sodium crystal is body centered cubic in shape in which each atom is surrounded by eight other atoms. The bond between two adjacent atoms is relatively weak and is responsible for the low m.p. and b.p. Similarly, less force of attraction between its atoms in the crystal lattice gives low density to sodium and is responsible for its softness.

On the other hand, magnesium has twelve neighbours in its crystal lattice. With two valence electrons to share among these twelve neighbours, the bond between two atoms may be considered approximately one sixth of a covalent bond. Thus in comparison to

sodium the stronger bonding of atoms in solid magnesium accounts for its higher m.p. The stronger interatomic attraction gives greater density and hardness to magnesium than sodium. It is also less compressible.

In case of aluminium the atom has twelve neighbouring atoms in its crystal lattice with three valence electrons to form stronger bonds (i.e. one fourth of the covalent bond). Therefore it has higher m.p. & b.p. and is of greater hardness.

In this way the nature of the metallic bond helps in explaining the gradation of physical properties of metals in a given period or group of the periodic table.

2. CHEMICAL PROPERTIES:

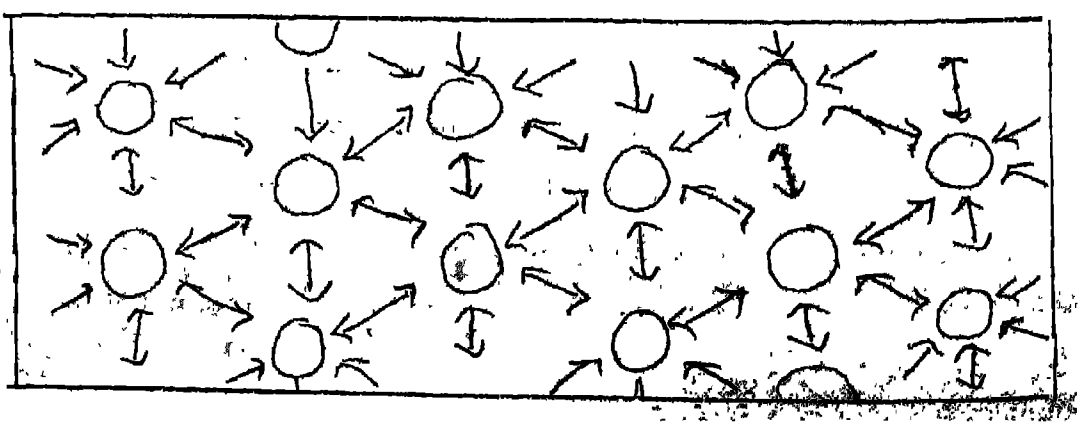
a) In chemical reaction metals act as electron donors to form positive ions. This is related to the ease with which the metal atoms lose electrons and also because there are usually less than four electrons in their outer energy levels.

b) They form basic oxides (some also form amphoteric oxides).

c) They form highly ionic halides.

d) Active metals form hydrides and carbides.

The metallic bond in a metal crystal.



CHEMICAL BONDING

Chemical bonding is the force which holds the constituent atoms together, or in broader sense is a short of interatomic, interionic or intermolecular attraction which holds the two constituents together.

Out of 106 elements discovered till now, the atoms of only 100 elements combine (with that of same element or some other element) as the combined state is more stable (lower energy) than the individual atoms.

But atoms of Rare gas elements do not combine except Xe (few compounds of Xenon are known). The stability of the atoms of the noble gas elements is attributed to their completely filled valency shell i.e. except Helium, all other have eight electrons in their outermost shell - Octet Rule. The combining capacity of other atoms is explained on the basis of the Octet Rule i.e. the atoms combine in such a fashion that they achieve eight electrons in their outermost shell either by donating, accepting or sharing of the electrons. But this rule fails to explain the formation of many stable molecules such as $BeCl_2$, BCl_3, PCl_5, SF_6 etc. which is well explained by the lowering of potential energy of the atoms as they combine to form the molecule. Hence the driving force for the bond formation is the net energy change of the system.

Types of Chemical Bonding:

The elements are broadly classified as electro-positive (metals) (which can donate electron)

and the electro-negative (non-metals which can accept electron) elements. These two types of elements can combine in three different ways thus generating three major types of chemical bonding. They are:

(i) Ionic Bond:

- is formed between strongly an electropositive element on the left hand side of the periodic table and the electronegative element on the right.
- is the electrostatic force of attraction between the cations and anions which are formed as a result of donor-acceptor relationship between the electropositive and electronegative elements.
- is non directional, as a spherical charged body (ion) can attract the oppositely charged body (ion) from all possible directions.

Ionic compounds thus formed are considered as the aggregation of ions, each ion is surrounded by a fixed number of oppositely charged ions (e.g. In (Na^+ Cl^-), Na is surrounded by six Cl^- and the vice versa). These compounds are hard crystalline solids, having high M.P., highly soluble in polar solvents like water, conducts electricity in the molten state or as a solution.

ii) Covalent Bond:

- is formed between the electronegative elements on the right hand side of the periodic table. Thus sharing of electrons takes place between the two atoms.
- is directional, as a result discrete molecules are formed.

Resulting covalent compounds are usually gases, liquids or high molecular weight once which are soft solids (exception: diamond); having low M.P. & B.P. non-conducting (exception: graphite), soluble in non polar solvents.

Due to the directional character of the covalent bond, the covalent molecules have definite geometrical shapes. According to the valency shell Electron Pair Repulsion Theory the shape of the covalent molecules can be predicted.

iii) Metallic Bond:

- is formed between the atoms of electro positive elements.
- is non directional, thus metals are considered to be the aggregation of atoms.

Resulting metals are hard solids (except Sodium (soft solid) and Mercury (liquid) of high M.P., good conductor of heat and electricity in the solid state are lusturous and malleable.

Apart from these above types of stronger bondings there are also certain weaker bonds, which are equally important and involves the interaction

between the molecules such as Hydrogen bonding and Vander waals force of attraction.

Very few chemical bonds are 100% pure. Depending on the electronegativity difference between the two bonded atoms the corresponding bond possesses mixed character of the two or three major types of bonding.

Questions:

1. In the _____bond two atoms are bonded together by sharing a pair of electrons, with each atom donating an electrons to the shared pair.
2. Covalent bonds occur between _____ elements.
3. Which one of the following bonds will be non-polar ?
   (i) The C - O bond in CO_2
   (ii) The Ca - Cl bond in $CaCl_2$
   (iii) The H - Cl bond in HCl
   (iv) The N - N bond in N_2
4. The nature of bonding in CH_4 will be
   (i) Electrovalent
   (ii) Covalent
   (iii) Metallic
   (iv) Co-ordinate
5. Consider the atoms A, B, C, D, E belonging to the second period and having valency electrons 1, 2, 6, 7 and 8 respectively. Suggest whether the bonding is possible or not, if possible predict the nature of bonding in the following cases:
   a) between A and E
   b) between A and A

c) between E and E

d) between B and D

e) between C and E

f) between D and E

g) write the electron dot structure of bonding between any two atoms.

KEY TO ABOVE QUESTIONS

1. Covalent bond
2. Electronegative elements.
3. (iv)
4. (ii)
5. (a) No bonding

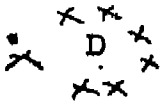
   (b) Metallic

   (c) No bonding

   (d) Ionic

   (e) Covalent

   (f) No bonding

   (g) A  D

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COUNTING OF RBC AND WBC

Dr.U.K.Nanda,
RCE,Bhubaneswar

Aim: To determine the total number of R.B.C. and W.B.C. per Cubic mm of blood.

Requirements

1) Ethyl alcohol 90%
2) Haemocytometer
3) Microscope
4) Needle
5) Absorbent cotton
6) W B C fluid or turk solution
7) W B C fluid or H

Procedure:

Clean the surfaces of the ring finger with alcohol. Allow it to dry. Sterilise the end point of the needle ever a flame, and then cool it. Puncture the skin of the finger tip and collect blood through R B C pippette upto the mark of 0.5. Then along with blood, quickly suck up R B C fluid upto the mark 101. Do not allow the blood to coagulate in the pippette. Rotate the pippette 2-3 times to allow mixing of the blood with salt solution.

Clean the haemocytometer slide. Take one drop of the blood mixture to above the chamber cover the chamber with cover slip. Observe the counting slide under microscope and find the cross line under high power count the number of R B C in any five smaller square.

(In case of W B C you have to take blood upto 0.5 mark then the W B C flued upto 11 mark in W B C pippettee).

Calculation for R B C Count:

Area of the counting chamber is 3 x 3 = 9 sq.mm

Area of the R B C chamber = 9/9 = 1 Sq.mm.

Area of the R B C smaller chamber (as R B C Chamber is divisible into 25 smaller squares)

= 1/25 Sq. mm

Area of the R B C smallest chamber (as each R B C smaller square is again divisible into 16 smallest squares)

.= 1/25 x 16 = 1/4000 Sq mm

Volume of the R B C smallest chamber =1/400X1/10

= 1/4000 Cu mm (As depth is 1/10 mm)

1/4000 cu mm of blood contains $\frac{x}{80}$ x DF (No.of RBC)

(D.F. or Dilution factor is 200 or 200 times the blood is diluted by RBC fluid

Thus one cubic mm of Cu mm blood contains

$\frac{x}{80}$ x 4000 x 200 (R.B.C.)

1) Preparation of Hayem's solution (W.B.C. fluid)

Hayem's solution has the following composition:

(i) Mercuric chloride ($HgCl_2$) = 0.5 gm

(ii) Sodium chloride (NaCl) = 1.0 gm

(iii) Sodium sulphate (Na_2SO_4) = 5.0 gm

(iv) Distilled water (H_2O) = 200 cc

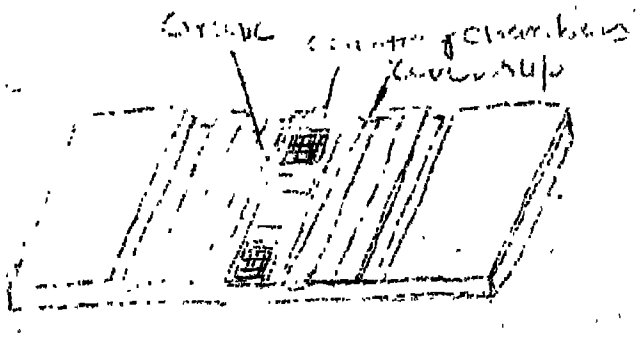

Fig. Glass slide with counting chambers

The mercuric chloride acts as corrosive sublimate and fixes the R.B.Cs present in the blood. The other ingredients act isotonically so that the R.B.Cs may not burst due to haemolysis. The Hayem's solution also serves to dilute the blood.

2) Procedure for W.B.C. counting

Procedure: Blood is obtained either directly from the heart of a frog or from some body part externally in case of man. Human blood is generally taken out from a finger (avoid thumb and first finger) which is thoroughly washed and cleaned by spirit or alcohol (absolute or 90%). It is now pricked by an ordinary injection needle which is also sterilised with spirit and dried before use. The finger is pricked quickly and effectively. It should not be pressed hard to let out blood so as to avoid other body fluids also oozing out. For this reason also the first one or two drops of oozing blood should be avoided and wiped off.

Now take the pippette meant for R.B.Cs which is already rinsed with alcohol or spirit or ether and thoroughly dried. Suck the blood in the pipette up to 0.5 mark taking care that air bubbles are not included. The excess of blood, if any, may be run out by touching the mouth of pipette to the palm. The blood which is sticking to the outer side of pipette should also be carefully cleaned. The pipette should now be transferred to the container of HAYEM's solution which is carefully sucked up to 101 mark. The pipette is now held horizontally between the fore-finger and

thumb or palm surfaces of the hand and rotated several times so that blood thoroughly mixed with HAYEM's fluid. The red bead in the pipette also halps in mixing. In this way dilution of blood becomes 200 times.

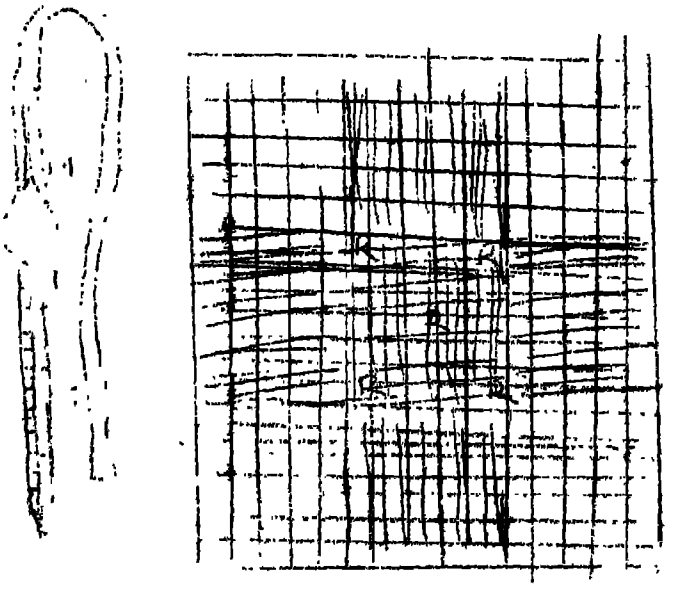

Fig. R.B.C. pipette and small squares in the counting chamber.
R. denotes small squares for red cell count.

Before starting to count R.B.Cs in this diluted fluids blood, place the covers-lip on the counting chambers. The coverslip is supported upon the side platform but remains separated from the central platforms by a distance of 0.1 mm. First reject 3 or 4 drops of mixture from the pipette. Now apply the tip of the pipette between the coverslip and the platform and allow few drops of blood mixture to flow in the narrow space between the coverslip and the counting chamber. If necessary both the chambers may be filled in this manner. Blood mixture remains filled up between the coverslip and the counting chambers because of capillary action. Air should not be taken into and also pouring excess blood mixture so that the H-shaped groove remains free from it.

When the counting chambers are properly flooded the slide may be kept aside for few minutes so tha t the R.B.Cs settled down on the bottom floor of the two counting chambers.

3) For W B C Counting

Area of a W B C chamber is 1 Sq mm depth is 1/ so volume of a W B C chamber is 1/10 Cu mm.

Total no. of cells in four W B C chamber = A + B + ...

Total number of cells in 1 W B C chamber= $\frac{A+B+C+D}{x}$

1/10 cu mm of blood contains x no. of W B C

1 Cu mm of blood contains x = 10 x DF W B C

(DF for W B C is 20)

So total no. of W B C is x X 10 X 20/cum mm of blood.

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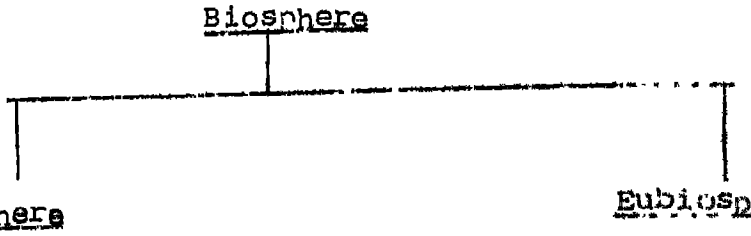
ECOLOGY

The term Ecology is derived from two Greek words 'Oikos' meaning 'house' and logos , which means to study Literally, Ecology is the study of organisms in their native environment or,'at home'. The term was first of all introduced by Reiter in 1868 but because the term was fully defined and extensively used by the German biologist Ernest Haeckel, he is credited for coinage of the term ecology. Various authors have defined ecology in their own way but the definition of South-wick is simple to follow.

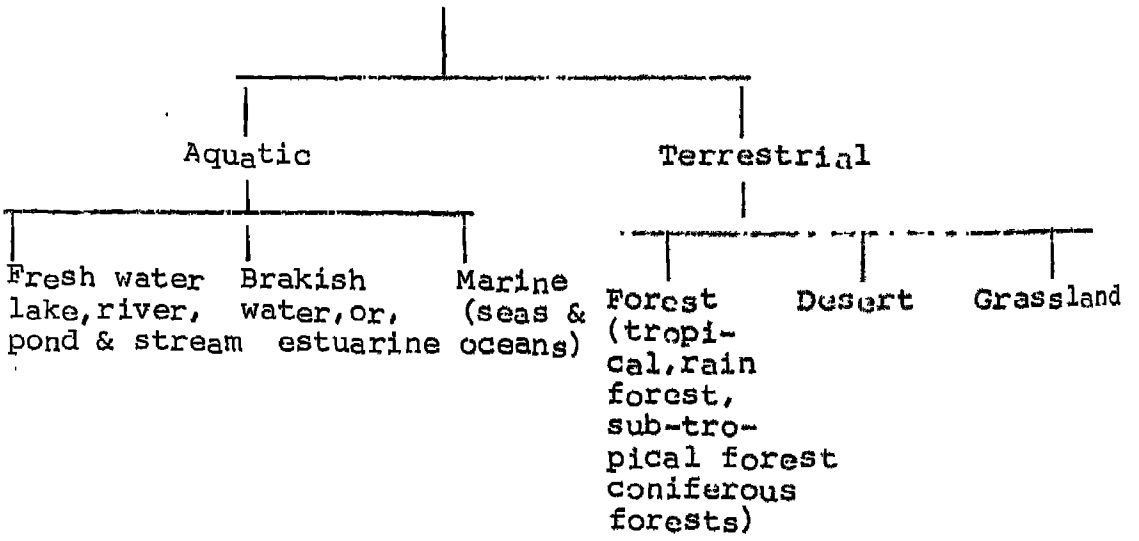
According to Southwick (1976), Ecology is the scientific study of the relationship of living organisms with each other and with their environments. Temperature, moisture, soil and light (abiotic factors) have profound effect on the life of organisms. Even since has origin, man is very much aware of changes in climatic conditions and using certain climatic conditions to his advantage and his way of living has also been regulated by the changes in climatic conditions. So the knowledge about environment and climatic conditions are associated with the history of man, although the word ecology was coined much later. During 19th and 20th century much work is done to know about the environment in which we live. The place where the organisms live and their sorroundings form the environment. The life supporting environment remains restricted to a thin surface zone around our planet earth, which is known as Biosphere. Biosphere can again be devided into



It is the region where severe environmental conditions exist, some organisms inhabit in such conditions only in the resistant Stages of their life cycle e.g. high altitude, cold polar regions, in worst polluted areas, regions of volcanic erruptions.

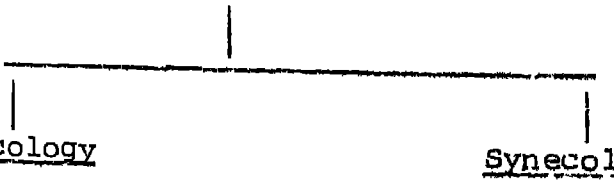
It is the region of biosphere in which active metabolic processes of the organisms is possible.

Within the biosphere, there are two major habitats, which are further devided.



Branches of Ecology:-

Ecology is devided into plant ecology and animal ecology and each one of them include



Deals with study of the individual organism or as individual species.

Deals with the study of groups of organisms which are associated together as a unit i.e. community.

Besides these major subdivisions, the ecology has been classified into the following branches according to the level of organisation, kind of environments or, habitats and taxonomic position.

(1) Habitat Ecology:- It deals with the study of different habitats of the biosphere. According to the kind of habitat, the animal occupies, it is sub-devided into marine ecology, freshwater ecology. dstuarine ecology and terrestrial ecology which comprises of ecology, grassland. ecology, forest ecology (Tropical rain forest, Sub-tropical and Coniferous forest)

(2) Ecosystem Ecology:- It deals with the study of structural and functional aspects of ecosystem.

(3) Conservation Ecology:- It deals with methods of proper management of natural resources like land, water, forests, sea, mines and wild animals for the benefit of mankind.

(4) Production Ecology:- It deals with grass and net production of different ecosystems and helps in the proper management to get maximum sustainable yield. It is a modern sub-division of ecology.

(5) Radiation Ecology:- It is the study of grass effects of radiations and radioactive substances over the environment and living organisms.

(6) Taxonomic Ecology:- Study of ecology of different taxonomic groups and eventually includes the following subdivisions of ecology - Plant ecology and animal ecology (Invertebrate ecology, insect ecology, vertebrate ecology, microbial ecology etc.

(7) Human Ecology:- It is the study of relationship of man with the environment.

(8) Space Ecology:- It deals with the development of partially or completely regenerating ecosystems for supporting life of man during long space flights.

(9) Cybernetics:- Control of the functioning of ecosystem is known as cybernetics.

(10) Systems Ecology:- It is concerned with the analysis and understanding of the structure and function of the ecosystem by the application of statistical techniques, mathematical models and computer science.

RELATIONSHIP OF ECOLOGY WITH OTHER DISCIPLINES

Modern ecology has taken a multidisciplinary dimension by combining with other disciplines such as Physics, Chemistry, Mathematics, Statistics, Meteorology Climatology, Geology, Geography, Economics, Sociology, Agricultural science, Forestry, Horticulture, Genetics, Physiology etc. This helps for the better understanding of the interdisciplinary approaches to ecology have given rise to the following sub-divisions of ecology.

(1) Chemical Ecology:- Adaptations of particular animals to particular chemical substances.

(2) Ecological Genetics:- The branch of Ecology dealing with genetics in relation to ecology is called ecological genetics.

(3) Ecophysiology:- Deals with the functional adjustments the organism undergoes in relation to diffierent ecological conditions of the same or, different ecosystems.

(4) Ecological Energetics:- It deals with conservation of energy and its flow within the ecosystem.

(5) Ecogeography:- It is the study of the role of environment in animal distribution.

Ecofloras and Ecofaunas are the smallest units of which a biogeographic flora or, fauna is made up of.

PALEOECOLOGY:- The study deals with the information about ancestral organisms and environmental conditions existing in the past, based on palaeontological evidence.

Pedology:- It deals the study of soil, its acidity, alkalinity, humus content, mineral content and soil type. It is a branch of terestial ecology.

Ecosystem

The word 'ecosystem' was coined by A.G.Transley (1935). An ecosystem is the basic structural and functional unit which include both the organisms(biotic) and non-living environment (abiotic) each in the properties of the other and both are necessary for maintainance of life. In each ecosystem there is a definite patterns of trophic level, biotic diversity and material cycle. Plants and animals and microorganisms form the biotic component and abiotic components include light, temperature, moisture and soil and air.

Components of Ecosystem:- There are two main components of Ecosystem. (1) Biotic (2) Abiotic.

Biotic component consists of

Autotrophs (Self nourshing) producers; which include chemosynthetic & photo synthetic bacteria, algae, mosses and vascular plants.

Function:-1) Capture the radiant (light) energy from Sun and store it as chemical bonds in organic molecules. For this reason autotrophs are called producers.

Heterotrophs (other nourishing) or, consumers.

- Micro
- Macro
  - Primary (Hebrivore)
  - Secondary called as carnivores.

2) As a source of food for animals.

3) Provide various habitats for organisms.

4) The effects on environment such as weathering of rocks and other actions changing the nature of soil.

5) Modification of climate.

6) Modification of gases in their environment.

Animals which can not produce their own food, but obtain energy from other living organisms, or, from faecal matters or, metabolic waste products or, from dead remains of plants and animals.

Functions:-

(1) Transfer of ions, elements & compounds from plants into their own protoplasm and excretion of many of these substances.

(2) Incorporation of energy stored in plants in their own protoplasm.

(3) Serving as population controll factor

(4) Depending upon their food habit & ecological functions, Heterotrophs are separated into the following distinct groups.

- Hervivores/Primary consumers
- Carnivores Secondary consumers
- Parasites Tertiary consumers
- Scavengers Tertiary consumers
- Decomposers Tertiary or quarternary

(A) Herbivores:- They are known as primary mac.ro-consumers. They get energy by eating plants and phytoplanktons.

(B) Carnivores:- Organisms eating on plant eating forms (hervivores) are known as Carnivores. Depending upon their feeding level they are designated as

i) Primary carnivores (eating on hervivores)

ii) Secondary carnivores (eating on primary carnivore)

iii) Tertiary carnivores (eating on Secondary carnivore) and so on.

(C) Parasites and Hyper parasites also are included under consumers. e.g. Ascaris, Taenia etc.

Hyper Parasites:- Parasites living inside the parasites (Protozoan and bacterial parasites.

e.g. Ascaris in human host harbouring protozoan and bacterial parasites.

(D) Scavengers:- Animals eating on dead animals and excreta of other animals are scavengers.

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FOOD CHAINS, FOOD WEBS AND TROPHIC LEVELS

Introduction

Living organisms and their non-living (abiotic) environment are inseparably interrelated and interact upon each other. Any unit that includes all of the organisms (i.e. the community) in a given area interacting with the physical environment so that a flow of energy leads to clearly defined trophic structure, biotic diversity and material cycles i.e. (exchange of materials between living and non-living parts), within the system is an ecological system or ecosystem. From trophic (trophe = nourishment) standpoint an ecological system has two components (which are usually partially separated in space and time), an autotrophic component (self nourishing) in which fixation of light energy, use of simple inorganic substances and build up of complex substances predominate, and a heterotrophic component (other nourishing) in which utilization rearrangement and decomposition of complex materials predominate.

From functional standpoint of view an ecosystem may be conveniently analysed in terms of the following:-

1) Energy circuits
2) Food chains
3) Diversity patterns in time and space
4) Nutrient (biochemical cycle).
5) Development and evolution.
6) Control (Cybernetics)

FOOD CHAINS, FOOD WEBS AND TROPHIC LEVELS

Food Chain:- The transfer of food energy from the source in plants through a series of organisms with repeated eating and being eaten is referred to as the Food chain.

At each transfer a large proportion of 80-90% of the potential energy is lost as heat, for no chemical transformation is perfectly efficient. Therefore, the number of steps or "links" in a sequence is limited, usually to four or five. The shorter the food chain (or the nearer the organism to the beginning of the chain), the greater the available energy.

Food chains are of two basic types.

(a) Grazing food chain

(b) Detritus food chain

(A) The grazing food Chain:- which starting from a green plant base, goes to grazing herbivores and on to carnivores.

Eg. In the open sea the plants carrying out photosynthesis are free floating microscopic green algae, principally diatoms and flagellat. Amongst the many animals which utilise these plants as food is small crustacean known as Calanus finmarachicus. This copepod crustacean is an important item in the diet of adult herring, thus the simple food chain is Chaetoceros delipens (a diatom) ------Calanus finmarchicus (a copepod) (herring)

The Principle of food chains and the working of the two laws of thermodynamics:

Energy inflows balance outflows as required by 1st law of thermodynamics and each energy transfer is accompanied by dispersion of energy into unavailable heat (i.e. respiration) as required by second law.

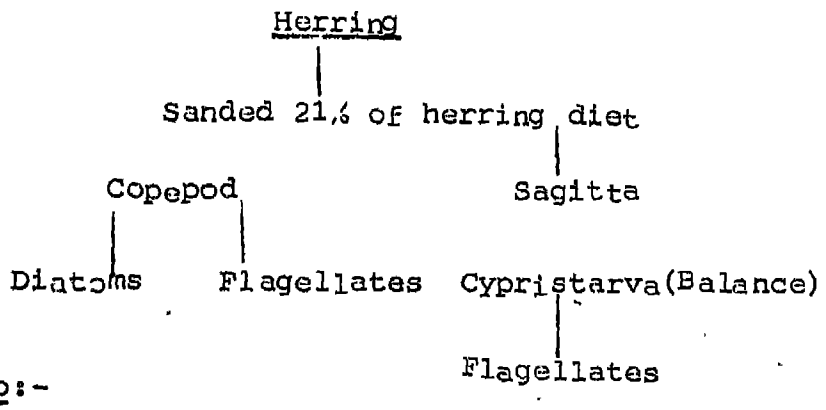
In addition to the operation of the second law of thermodynamics, size of food is one of the main reasons underlying the existence of food chains, as Elton (1927) pointed out. This is because there are usually rather definite upper and lower limits to the size of the food that can efficiently support a given animal type. The matter of size is involved also, in a difference between predator chain and parasite chain; in the latter organisms at successive levels are smaller andsmaller instead of being generally larger and larger.

Eg. Roots of vegetable crops parasitifed by nematodes which may be attacked by bacteria and other smaller organisms.

(B) Detritus Food Chain: Held (1969), W.E. Odum (1970). In brackish water zone of Southern Florida, leaves of the red mangroove (Rhizophora mangle) fall into warm shallow waters at an annual rate of 9 metric tones per hecter. Since only 5% of the leaf material was found to have been removed by grazing insects before leaf abscission, most of the annual net production becomes widely dispersed by tidal and seasonal current over many square miles. The particlesingested by the detritus feeders range from sizable leaf fragments to tiny clay particles with

organic matter. Small fishes feed on detritus consumers and large game fishes, feeding on the smaller ones.

In marine community the energy flow via the grazing food chain is shown to be larger than via the detritus pathway, where as reverse is shown for forest in which 90% or more of the net primary products is normally utilized in the detritus food chain.



Food Web:-

Food chains are not isolated sequences but are interconnected with one another (a large number of other food chains). The interlocking pattern is often spoken as food web.

Ex: Diatoms — Copepods------ Sandeel ------ Herring
Flagellates — (Calamus) — Ammodytes spp.
21% of herring diet. — 40% of adult herrings diet(Frater 1962)

Flagellates----- Cypris ------- Sagitta
Varnacle larva — arrow worm

Thus it is obvious that more than 3 links may be involved in a food web. Plant ------ herbivore ----- Carnivore ------ Carnivore and --------- Carnivore Elton 1927. In complex natural communities, organisms whose food is obtained from plants by the same number of steps are said to belong to the same trophic level.

Trophic levels

1) Green plants (producer level)
2) Plant eaters (Primary consumer)
3) Carnivores feeding herbivores (Secondary Consumer)
4) Secondary Carnivores (Tertiary Consumer)

Trophical classification is one of the function not of species as such, a given species may occupy one, or more than one trophic level according the source of energy assimilated.

Energy Flow through a trophic level = Total assimilation (A) at that

Level = Production (P) of biomass + Respiration (R)

Tracing Food Chains and Food Webs

A number of different methods have been employed in determining food chains and food webs.

TROPHIC STRUCTURE AND ECOLOGICAL PYRAMIDS

The interaction of the food chain phenomena (energy loss at each transfer) and the size - metabolism relationship results in communities having a definite trophic structure which is often characteristic of a particular type of ecosystem (lake, forest, coral reef, pasture etc.). Trophic structure may be measured and described either in terms of standing crop/unit area or in terms of the energy fixed/unit area/unit time at successive trophic levels.

Trophic structure and also trophic function may be shown graphically by means of ecological pyramids in which the first producer level forms the base and successive levels, the tiers which make up the apex. Ecological pyramids may be of three types,

NUTRITION

* Introduction
* Terminologies
* Objectives of Nutritional studies
* Functions of food
* Classification/Components of food
* Metabolism of food
* Energy requirements
* Balanced Diet.
* When more food is required
* Deficiency diseases
* Factors leading to deficiency of nutrition
* Excessive Intake of food
* Food Adulteration.

INTRODUCTION:- Good nutrition for people of all ages for health, maintainance as well as restoration of health is an economic, political and humanitarian concern . Majority of consumers in developing countries are not aware of the nutritive quality of the food and suffer from malnutrition, as a result of ignorance or poverty or both. By providing nutritional services and extending nutrition education, nutritionists and dietitians, nurses, physicians, home economist, Dental hygienists and dentists and other health workers have an unparallel opertunity to work towards the improvement of nutritional status of the population. Educatinnal programmes in nutrition within the schools nd community levels will go a long way to make people aware of efficient use of food within home, public eating places and institutions.

Definition:-

Nutrition is the "Science of foods, the nutrients and other substances therein, their action, interaction and balance in relationship to health and disease, the progress by which the organism ingests, digests, absorbs, transports, and utilizes nutrients and disposes of their end products. In addition, Nutrition must be concerned with social economic, cultural and psychological implications of food and eating or in short' 'Nutrition is the science that interprets the relationship of food to the functioning of the living organisms. It includes the obtake of food, liberation of energy, elimination of wastes and all the synthesis essential for maintainance, growth and reproduction.

Terminologies:-

Terminology in any study is a basic need to understand the use of terms, with accuracy and ease.

Health:-

It is the state of complete physical, mental and social well being and not merely absence of disease or, informity.

Nutrients:-

Nutrients are the constituants that must be supplied to the body in suitable amounts. These include proteins, carbohydrates, fats, minerals, vitamins, fibres and waters.

Nutritional Status:- is the condition of health of individual as influenced by the utilization of the nutrients.

Nutritional Care:-

It is the application of science and art of human nutriti n in helping people, select and obtain food for primary purpose of nourishing their bodies in health or in disease throughout the life cycle.

Some goals in the study of nutrition:-

The first goals in the study of nutrition, should be directed to oneself. Physical and mental health are essential assets to meet the exciting, and sometimes ardous, requirements of one's life work. Those who expect to help other people achieve better health through nutrition must be enthusiastic and living examples of the benefits of the application of nutrition knowledge.

Nutrition education applied to the individual also reaches the family. This is especially important for young men and women as they establish their own families, within the family the wife and mother is the principal decision maker for the family food; she plans the menus, selects the foods and prepares them. So the education of women population regarding nutrition promises long-range benefits to the greatest numbers.

Objectives of the Nutritional Studies:-

1) Acquire the proper attitude and connections relative to the importance of nutrition in regulating one's own health, that of the family, and that of individuals of the community.

2) An appreciation of the kinds of health problems arising from poor nutrition that exist in his own community, the nation and throughout the world.

3) Acquire knowledge concerning the role of nutrients in the functions, digestion, absorption, and metabolism of proteins, fats, carbohydrates, minerals and vitamins.

b) The interrelationships of nutrients.

c) The nutritive requirements of individuals and the variations that may be caused by age, activity, climate, stages of life cycle, and disease.

4) Gain appreciation and understanding of the meanings that food has for people and how these are related to economic, psychologic, and cultural factors.

5) Develop the ability to interpret the principles of in the selection of an adequate diet.

a) By knowing food sources of the nutrients.

b) By applying consumer information to the planning of meals and the selection of food for quality and economy.

6) Develop awareness of opportunities for improving nutrition through the education of individuals.

7) Develop the ability to counsel people on an individual or group basis by adapting nutrition information to specific health, socioeconomic and cultural needs.

8) Know where to look for reliable sources of information and how to evaluate publications of food and nutrition and claims made through product advertising.

9) Become familiar with agencies concerned with nutrition and health in order to utilize their services and contribute to their functioning.

FOOD

Functions of food:-

1) To provide the chemical elements or compounds essential for the synthesis of protoplasm (i.e. for building of new tissue or the repair of injured or worn-out tissue). They also provide the materials for growth and those from which secretions of glands are synthesized.

2) To serve as a source of heat and energy for metabolic activities and for the maintainance of body temperature.

3) To provide essential substances for regulation of cellular or, body functions.

CLASSIFICATION OF FOODS

(Organic Compounds Serving as a source of energy)

CARBOHYDRATES:-

Monosaccarides (Simple sugars):- Simplest form of the Carbohydrates, empirical formula $C_6 H_{12} O_6$. They may be aldehydes (aldoses) and ketones (Ketoses) according to the no. of carbon atoms in the chain.

Disaccarides:-

a) Double sugars

b) Upon hydrolysis, they yield two molecules of simple sugar.

c) Empirical formula $C_{12} H_{22} O_{11}$

Polysaccerides:- a) Multiple sugars

b) Insoluble in water

c) Empirical formula ($C_6H_{10}O_5$)

Carbohydrates utilised by the body-starch, sucrose, lactose, glucose and fructose. Not utilized are cellulose and hemicelluloses.

Carbohydrates as a source of energy on average diets - supply about 40 - 80% of total calories in the diets.

Functions:-

(1) As content of the body :- Human body weighing 70 Kg. approximately contains 370 g of Carbohydrates in different tissues.

(2) Protein sparing action of CHO:- Carbohydrates meet the energy needs of the body sparing protein for tissue building.

(3) In Oxidation of fats:- In the oxidation of fats, the acetyl COA formed from the oxidation of fatty acids reacts /- with Oxaloacetic acid (formed from aspartic acid) to form citric acid which is oxidised through the TCA cycle back to oxaloacetic acid through a series of reactions. If adequate amount of Oxaloacetic acid are not available, acetyl COA is formed in large amounts from the oxidation of fatty acids and a part of it is converted into ketone bodies (aceto-acetic acid and B . hydroxy butyric acid) which accumulate in blood and tssue and produce the oxidation ketosis.

(4) Energy for nervous system:-Main source of energy is to CNS is glucose.

(5) Sources of energy for muscular work:- Major source of energy for muscular work.

Many foods containing fibre also contain pectin, which binds to Calcium inthe body to form calcium pectinate. This calcium pectinate then combines with bile acids produced in the body and makes the acids unavallable to do their duty in digesting dietary fat. The digestive system senses that there is a storage of bile acid and goes to work. It extracts the cholesterol molecules from the blood and converts them into bile molecules. That is how one theory says, fibre, helps in reducing cholesterol in blood (Pectins are formed by the Combination of a no. of galacturonic acid - hydrogalacturonids residues on hydrolysis ----- galaturonic acid, small amounts of galactose and arabinose.

Sources of CHO in the diet:-

Cereals, millets, roots, tubers, pulses, sugar, Jaggery, fruits, milk and sugar.

LIPIDS OR FATS

Lipids are compounds of C, H, and O.

Classification:- Classified as follows:-

(a) True fats (esters of fatty acid and glycerine)

(2) Lipoids:- Fat like Substance like (Phospholipids a and phosphatides) i.e. Lecithins and cephalins.

(3) Sterols (Hydrogenated phenethrin derivatives):- i.e Cholesterol and ergosterol.

(4) Hydrocarbons

Further lipids can be classified as:-

(a) Simple Lipids:- Triglycerides are esters of fatty acid and glycerol, which accounts for 93% of fats in food and over 90% of the total fat in the body.

(b) Compound lipids:- Upon hydrolysis, this group yeilds other molecules i.e. Phosphoric acid and Nitrogen base in addition to fatty acid and glycerol. Among these are phospholipids i.e. lecithin, Cephalin and sphingomyelin.

(c) Derived Lipids:- These include fatty acids; alcohols (glycerol and sterols); Carotenoids, and fat soluble vitamins A, D, E and K.

FATTY ACIDS:- Most fatty acids in foods and in the body are straight even-numbered carbon chains containing as few as 4 or as many as 24 carbon atoms: short chain fatty acids contain 4 - 6 carbon atoms, medium chain fatty acids contain 8 - 12 carbon atoms and long chain contain more than 12 carbon atoms.

Fatty acids are 'saturated' or 'unsaturated'. A fatty acid in which each of the carbon atom's in the chain has two hydrogen atoms attached to it is saturated and unsaturated fatty acid is one in which a hydrogen atom is missing from each of the two adjoining carbon atoms, thus necessiating a double bond between two carbon atoms. Unsatura-ted fatty acids can exist as geometric isomers in the 'Cis' form, the molecule folds back upon itself at each double bond and on 'trans' form the molecule extends to its maximum length. The form in which fatty acid occurs, markedly influences the melting point and other properties of fat.

Functions:-

(1) Important Source of energy:-

Primary function of fat is to supply energy. Each gram of fat yielding approximately 9(nine) calories when oxidised.

(2) Insulation and Padding:- The subcutaneous layer of fat is an effective insulator and reduces loss of body heat in cold weather.

(3) Essential Fatty acids:- Linoleic acid is an essential fatty acids that can not be synthesized in the body and must be present in the diet. These are constituent of Phospholipids that cellular membranes and thus appears to have a role in regulating the cell permeability and transport of lipids in the circulation. Linolenic acid is another polyunsaturated fatty acid that promotes normal growth in animals.

(4) Phospholipids:- All cells contain phospholipids but brain nervous tissue and liver are specially rich in them. These are essential to the digestion and absorption of fat and they facilitate it to obtake the fatty acid by the cell.

(5) Cholesterol:- The concentration of Cholesterol is high in the liver, the adrenal, the white and grey matter of the brain and the peripheral nerves. It is present in small amount in all body tissues and constitutes an important fraction of the blood, lipoproteins. It is synthesized by the liver to meet body needs of dietary intake, cholesterol furnishes the nucleus for the synthesis of Provitamin D, adrenocortical hormones, steroid sex hormones and bile salts.

Metabolism:- The blood is the means of transportation of lipid from one site to another and the liver adipose tissue are the specialized organ that control lipid

(6) Special functions in liver:-

(a) Detoxifying action and a regulating influence on protein and fat metabolism.

(b) Sources of energy for heart muscle - Heart muscle uses glucose as a source of energy.

(7) Synthesis of ribose from glucose:-

Glucose $\xrightarrow{\text{Pentose Pathway}}$ ribose present in RNA and many mucleotides.

Conversion of CHO to fat

Excess calories in the diet stored in the adipose tissue of the body as fat.

Formation of CHO from proteins:-

During starvation protein is broken down to meet energy needs. Glucose is formed from proteins in diabetes mellitus

Carbohydrates from fats

Glycerol present in fats forms CHO .

CHO not utilised by the body

Indigestible polysaccarides cellulose and hemicelluloses are known as Fibre.

(a) They are important in the movement of food through alimentary canal, thus preventing constipation.

(b) Cholesterol metabolism:-

Source- fruits, vegetables, cereals and grains

Incorporation of fibre in the diet brings about a reduction in the serum Cholesterol by preventing the absorption of cholesterol. Fibre not only binds water thus promoting regularly but it also helps indirectly.

metabolism. The synthesis of new lipids (Lipogenesis) and the catabolism of lipids (Lepolysis) are continuously taking place . These reactions are catalysed by specific enzymes under the controll of nerves and hormonal mechanism.

Blood Lipids:- Since fats are insoluble in water, protein provide the mechanism for that transport in the aqueous medium of blood. These protein - lipid complexes are known as lippoproteins. The chylo-microns synthesized in the intestinal mucosa are large particles constituting principally of triglycerides. They are rapidly hydrolysed by lipoprotein lipase and released fat are used by the tissue.

and B lipoproteins:- The greatest concentration of lipid in the blood consists of two classes of lipoprotein. High density or lipoproteins contain a large proportion of protein phospholipid and cholesterol. This class is little affected by changes in diet or, by age. Low density or, B lipoprotein includes a no. of groups that varies widely in density and in their proportion in triglycerides, cholesterol - phospholipids and protein.

Free Fatty Acid:- are principal source of fatty acids made available to the cell for energy. They enter into circulation as the result of hydrolysis of triglycerides chiefly by adipose tissue. The fatty acids are attached tightly to plasmoalbumen and do not circulate in their free state. At the cell surfaces, the fatty acid is released with ease from its carrier. The concentration of free fatty acid in the blood at any given time is

quite low, but the rate of turn over is so rapid that several thousand calories are transported daily in the circulation in this way. The concentration of fatty acid is some what higher in the circulation during fasting indicated more rapid release from adipose tissue. It is somewhat lower when carbohydrate is absorbed, indicating that carbohydrate is being used for energy as well as in the synthesis of the fatty acid.

ADIPOSE TISSUE AND FAT METABOLISM:- Like other tissue, adipose tissue is constantly being remolded. It synthesizes stores and release fats. Fat synthesis and breakdown continuously, but they are in equillibrium when the energy needs in the body are exactly made. Insulin is required for synthesis of fat. When a caloric deficity exhibit, the adipose tissue will be catabolised more rapidly, than it will be synthesized (weight is lost).

LIVER AND FAT METABOLISM:- The liver is the key organ in the regulation of fat metabolism. It is able to accomplish the shortening and lengthening the carbon chain of the fatty acid and to introduce double bond into fatty acids. For ex.- A double bond can be introduced into steoric acid to yeild Oleic acid. The liver is probably the chief regulator of the total body content of cholesterol and of the circulating blood cholesterol. It governs the endogenous synthesis of cholesterol, the removal of cholesterol for circulation, the production of bile acid from cholesterol and excretion of cholesterol and bile acids by the way of the bile in to the intestine.

Synthesis of Fat:- Triglycerides are synthesized by epithelial cells of the intestinal mucosa, by the adipose tissue, and by the liver. In order to synthesize triglycerides, a source of α - glycerophos-phate is essential. This is furnished by the normal oxidation of glucose that occurs in each of these tissue through Embden-Meyerhof pathway. A second sources of α - glycerophosphate is available from the glycerol released from fat Hydrolysis in the intestinal mucose and in the liver. Fatty acid for triglyceraldehyde molecule are available from the hydrolysis of fat, glucose and ends Amino acids. The synthesis of F.A. from Acetyl CoA is seen to be dependent on normal carbo-hydrate metabolism and require insulin.

OXYDATION OF FATTY ACID:-

All cells of the body except these who control nervous system can oxidise fatty acid to yeild energy B - oxidation is major pathway for oxidation of fatty acid. By the process oxidation occur at the carbon that is B . from the carboxyl group. This requires co-enzyme A and is complete in 5 steps, the end result of which is a fatty acid that is two carbon shorter + a molecule of acetyl CoA . . Acetyl Co A enter Kreb's cycle for oxidation to energy Co_2 and H_2O. or, it can be used for the synthesis of new fatty acid Cholesterol and other compounds.

Ketogenesis:- Within the liver 2 mol. of acetyl Co-A can condense to form acetoacetyl Co-A, which in turn yields Acetoacetic acid, -hydroxy butyric acid and

acetone. These compounds are known as ketone bodies and process is ketogenesis. The principal effects to increase production is disturbance of acid-base balance.

CHOLE-STEROL METABOLISM:- Liver and intestine are the chief site of cholestoral synthesis, but all cells are able to produce some cholesterol. The endogenous production of cholesterol is estimated at 1000 or, 2000 mg daily and is apparently independent dietary supply. The body able to break down the cholesterol nucleus, but the liver convert it by enzyme action to bile acids. Cholesterol as such as bile acids are constituencs of bile, and excretion occur from intestine. The concentration of cholesterol varies considerably and may be secreted during periods of emotional stress, physically inactivity and obesity.

Some points for emphasis in Nutrition Education

1) Fats are essential constituents of the body being the principal way in which the body stores energy.

2) Fats are the most concentrated source of energy in the diet and furnish more than twice as many calories, gm for gm. as do carbohydrate and proteins. Consequently, a small volume of fatty food will increase the calorie intake considerably.

3) When an individual consumes a diet that provides more calories will be stored as fat regardless of the composition of the diet. On the other hand, when an individual consumes a diet that supplies fewer calories than he needs adipose tissue will furnish the additional needs.

4) A diet, that provides 35% of the calories from fat, allows a wide latitude of food choice that is acceptable to Americans. Some of the foods choosen should be good sources of vitamin A.

5) Foods fried at the proper temperature may be used in moderation by most people perfectly they should not be given to very young children.

(6) Cholesterol is an essential constituent of body tissue and is required for the regulation of important body function . It does not need to be in the diet because the liver can readily synthesize it. On the other hand, a modest intake as provided by the recommendation and with good nutrition.

(7) A diet that contains a high proportion of saturated fatty acids and of cholesterol is one of many factors that is believed to contribute to cardivascular disease.

(8) In advising Americans about way to modify their diet without resorting to distort dietary patterns or faddism, the following guidelines seen appropriate:-

(a) Include first these basic foods that are essential for protein, minerals and vitamins.

(b) Select fat for food proportion from oils rich in linoleic acid as well as from solid fats.

(c) Trim visible fat from meats, use more poultry and fish.

(d) Substitute fruit and low calories disserts more frequently for high fat disserts.

(e) In choosing foods for additional calories, place emphasis on the [illegible]

MICROSCOPY

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A direct study of the structure and composition of a biological specimen is possible with the help of a microscope. Basically, the object is 'illuminated' by means of some form of 'light' or 'radiation' and its magnified image is formed by means of some kind of 'lenses'. The two most important forms of microscopy used in biology are optical microscopy and electron microscopy. In the former, ordinary light is used as the illuminating agent and glass lenses are used for image formation. In electron microscopy, beams of high energy electrons take the place of light and electric or magnetic fields are used to form images.

Length Scales:- In biological studies lengths involved vary from metres (m) to Angstroms (A). The following length scales are generally used.

1 μm (micrometer) = 10^{-6} m

1 nm (nanometer) = 10^{-9} m

1 A (Angstrom) = 1 dnm (decinanometer) = 10^{-10} m = 0.1nm

Some typical sizes encountered in biology are:

Cells : 10 - 10^3 μm

bacterial: 0.1 - 10 μm

viruses : 0.01 - 1 μm

cell organelles : 0.01 - 10 μm

biological macromolecules : 1 nm - 1 μm

biological molecules : 1 - 10A

Electron wave:- It was suggested by Louis de Broglie in 1923 and experimentally proved by Davission, Germer and others that moving electrons behave like waves with wavelength (λ) given by the expression $\lambda = \frac{h}{p}$, where h = Plancks constant = 6.6×10^{-34} Joule-sec and P is the momentum (mass (m) times the speed (v) of the electron). Thus, the faster an electron travels, the less becomes its wave length. This property of the electron and the fact that beams of electrons can be bent and focussed by electric and magnetic fields were exploited by Ruska to design electron microscope in 1932.

As an example, let us calculate the wavelength (λ) of an electron which has been accelerated by a voltage (v) of 50 kilo-volt ($= 5 \times 10^4$ volt).

Using the relativistic expressions we get

$$= \frac{hc}{ev(ev + 2m_o c^2)}$$

Where c is the speed of light in vacuum ($=3 \times 10^8$ m/s),

e is the magnitude of the charge of electron ($= 1.6 \times 10^{-19}$ kg)

m_o is the rest mass of electron ($=9.1 \times 10^{-31}$ kg)

For V = 50 kilo-volt, we then get $\lambda = 0.054$ A which is something like 5 orders of magnitude smaller than the wavelength of visible light.

Three important characteristics of microscopy:-

The three most important factors which influence the working of a microscope are: resolving power (R.P.), magnification (M) and contrast. These factors themselves influence each other.

Resolving Power: It is the smallest separation between two points which can be clearly perceived by a lens and is usually defined as follows:

$$R.\ P. = \frac{\lambda}{\text{(numerical aperature)}}$$

Where λ is the wavelength of the light or waves used for illumination, and numerical aperture is a dimensionless constant depending on the size and design of the lens. Maximum resolving power is obtained, for numerical aperture = 1 and is thus equal to $\lambda/2$. For light microscope and green light ($\lambda = 5000\ A^{\circ}$) to which our eyes are most sensitive, R. P. = 2500 A°. For a normal human eye, the nearest distance of distinct vision is about 25 cm and resolving power = 0.25 mm. For an electron microscope operating at 50 kilo-volt, resolving power would be $0.027A^{\circ}$. However, due to problems inherent in the design of electron lenses, the best resolving power of an electron microscope is about 2 A°.

Magnification (M):- For a single lens or a simple microscope, magnification is defined as the ratio of the size of the image and the size of the object pertaining to the lens. For a combination of lenses or for a compound microscope, the final magnification is equal to the product of magnification of all component lenses However, since finally we are going to see the image through our eyes, the inherent resolving power of the human eye sets an upper limit to magnification that can be fruitfully used. One thus defines, for a microscope,

$$\text{Maximum useful magnification} = \frac{\text{R. P. of eye}}{\text{R. P. of microscope}}$$

Which is equal to 1000 for light microscope using green light and 10^6 for an electron microscope. Any magnification in excess of the above does not improve the clarity of the image and is called 'empty magnification'.

Contrast:- All the resolving power and magnification of a microscope would become useless unless a proper contrast is obtained between the various portions of the image. Selective absorption of light or electrons by the various parts of the sample is essential for obtaining contrast. In optical microscopy, staining with dyes is a solution of the problem of contrast. The same procedure is also adopted in electron microscopy, but the stains are now solutions of heavy metals like osmium tetroxide or uranyl acetate. The metal is taken up differently by different components of a specimen resulting in differential electron scattering and thus good contrast.

Specimen prepara-tion:-

In case of light microscopy specimens usually do not need special preparation other than staining. On the other hand, in case of electron microscopy special care has to be taken for preparing the sample for viewing, Specimen must be very thin ($\sim$ 500 A^o) to ensure that there is no appreciable absorption of electrons passing through the sample. In case it happens, there would be differing spreads and therefore, wavelengths, in the electron beam passing into the microscope. This would lead to different electrons coming to focus at different points thereby creating an unsatisfactory, unsharp image. This is what is known as chromatic oberration.

It is known that fast electrons have a range of only a few mm in air. Thus, electron microscopes employing beams of high energy electrons have to operate in high vacuum. Samples have to be dried in order not to spoil the vacuum through evaporation. Since conventional means of drying may damage the samples, they may preferably be freeze dried.

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UNIVERSE AND ITS UNITS

Every day a child sees the bright sun in the morning and in the night the moon, planets and millions of stars. The nature has provided such a beautiful observatory to explore but still very little thought is given to this aspect to motivate the students to learn more about the universe surrounding us.

A naked human eye can see things which is at a far off distance and also stars which are several light years away from us through their light. If you sit on a sea shore, you can view upto a distance of 5 miles where the horizon and sea mets . This is associated with the geometry of the earth. This human faculty is unique.

Astronomy being one of the oldest sciences, how to motivate students to learn more about the universe. Suppose a question like 'where do you live' is posed to a student, the expected answer is that he gives his address. But of course he has not really told you where he lives - in space. Let us locate ourselves in space as best as we can. Just what is our address in the universe. This is a very confusing question to answer because which ever direction we look, we see space. Just like when you are on high sea, you see blue water in every direction. Similarly which ever direction we look, we see galaxies and our galaxy seems to be at the center of the whole show. We know that we live on one of the nine planets that orbit the sun. We are told that the sun itself is speeding through space on an orbit of its own that takes it around the center of

our galaxy - the Milky way. And our own galaxy also is a collection of billions of stars, companion to the sun. Further, we know that our galaxy is but one of billions of galaxies.

Our apparent feeling of being at the center of the universe is an illusion just like you are in the midst of a huge crowd of people. You see nothing but people no matter whichever direction you look and feel that you are in the exact center of the crowd.

GALAXIES

What do galaxies look like? How they are distributed in space? How do they differ among themselves? So one may have an unending questions like this.

Our own galaxy, the Milky way, is in a highly flattened shape, which is the characteristic of a large class of galaxies. We have no chance of seeing stars in the distant galaxies. The galaxies are not distributed uniformly in space, but seem to occur in spacious clusters. A single cluster may contain thousands of galaxies.

However we may reasonably assume that galaxies are uniformly distributed. Each galaxy is a gigantic collection of stars, often containing as much or more non-luminous material, in the form of interstellar gas, dust and sub-luminous stars, than normal stars.

Most of the galaxies can be easily separated into one of the four groups as suggested by Edwin Hubble.

(i) Spiral : that show loosely or tightly bound spiral arms.

(ii) Elliptical: in which the spinal arm are absent but which retains a lens shaped form in varying degrees of flattening or ellipitcity.

(iii) Barrel spiral that exhibit a prominent bar through their central region and which sprout spiral arms from their end.

(iv) Irregular: whichseems to be just huge collection ofstars, dust and gas without clear pattern.

INSIDE A GALAXY

What about our own galaxy? We can view this galaxy from inside. It is difficult to get an overall view or the house you live in if you are forever confined to the inside and can never go outside to take a look at it from across the road. It would be especially difficult if you could not wander around exploring first one room and then another. And such is our situation. However, we do make a round trip of our galaxy in the course of 260 million years as we tag along with the sun on its journey. Further, the sun's orbit, lies fairly close to the central plane of our galaxy and never brings us closer than some 25,000 light years to the galactic center. The other stars travel about the center of the galaxy too but at different speeds.The whole galaxy rotates like a giant pinwheel.

Our sun is too far away from the center of our galaxy that it is difficult to get a detailed view of what the center looks like and also due to dusty space intervening. As a result only a fraction of 1% of the light from the central region of our galaxy gets through to us. Our galaxy appears to have more matter in the form of dust and gas than the matter in other galaxies in the form of stars. These matter lies almost in the central plane of the galaxy. So the hallmark of spiral galaxy is the dust and gas; if we were in elliptical galaxy we would have a far more clear view of the center of the galaxy. It was Galileo, with his telescope, who first resolved the milky haze into countless distant stars. The stars of the milky way, also travel around the center of the galaxy in orbits that lie close to the central plane. So when we look at the milky way in the sky, we are looking at the giant stellar pinwheel from the inside.

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E N E R G Y

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We begin by recalling a beautiful piece of catechism by Allan A. Glatthorn:

"What is the test ?

Being and becoming, not remembering and reviewing". When a child is learning a concept he/she should be able to understand and apply it in appropriate situations. At the same time, he/she is expected to recognize happenings and phenomena from the surroundings where the concept is playing a role. It is also important to correlate the various concepts appearing in a field of study. All this will help in a balanced growth of the learner's mental level, personality, outlook and attitude towards nature and fellow human beings. Tests need be designed to take care of all these aspects of learning. A mere memory-recall type of test is not enough. More emphasis be put on understanding and application aspects. On the whole, a test ought to assess not only what the child is learning for his/her immediate purpose but also what he/she is learning for future. It is needless to say that the teaching be geared accordingly.

Energy is an abstract concept. It is not one of those things which can be perceived directly by our sense organs. We can know about it only indirectly, for example, through the work a body is capable of doing. Energy is thus a concept which is not easy to visualize. Teaching/learning of such a

subject is expected to be difficult. At the secondary level, the treatment of the subject is primarily qualitative and is mostly information-based. As per the text book, pupils are expected to learn about

- the need for energy
- the various forms of energy
- the conventional sources of energy
- energy crisis and alternative sources of energy
- environmental impact of energy
- misuse and wastage of energy and how to minimize/avoid them.

It is not enough to know how scientists are trying to generate more and more energy from various conventional/unconventional sources to cope with the demands of an ever growing human population. Shortage and wastage of energy, environmental pollution resulting from mindless use of energy and its serious consequences are issues which are extremely important today. The young learners must be made aware of all these problems, and the awareness be assessed by suitable test items.

In the following, we consider, as an example, chapter 1, namely Solar energy. We first state briefly what a child is expected to learn here. A list of the main concepts specific to the chapter is given next which is followed by a list of pre-requisite concepts/ facts needed to understand the present chapter. These lists are expected to help in designing teaching strategies/test items. Finally, a set of sample test items appropriate to the chapter is given.

Chapter 1: Solar Energy:

I. The pupils are expected to learn that

- the sun is the basic source of energy available on earth.
- the Sun is generating energy by fusion of hydrogen nuclei to helium nucleus at extremely high temperature.
- the world's energy use in one year equals one hours's sunshine
- solar energy is available to us mainly in the form of heat and light
- solar heat energy is directly used in solar heaters and solar cookers
- solar light energy is converted to electrical energy in solar cells.

II. Main Concepts/Ideas

Plasma state of matter, fusion, solar radiation (visible, ultraviolet and infrared radiations), solar heater, solar cooker, solar cell, photovoltaic effect, p-type and n-type semiconductors.

III. Prerequisite Concepts/Ideas

Definition and units of energy, atomic structure of matter, $E = m c^2$, heat energy, light energy, photosynthesis, semiconductor.

IV. Sample test items

1. It is ultimately the Sun which runs a motor-bike. Justify the statement in a few sentences.

2. We live as long as the Sun lives. Explain briefly.

3. State five direct uses of solar energy.

4. Name the most harmful component of solar radiation reaching earth. How are we protected from it ?

5. Tick the correct answer.

   Heat energy comes from the Sun in the form of ultraviolet radiation/visible radiation/ infrared radiation.

6. Give an example where light is produced without heat.

7. Give an example where heat is produced without light.

8. The people world over are showing great concern over an environmental problem popularly known as 'Ozone hole'. An important component of solar radiation is named in this connection. What is it ?

9. Calculate the energy in eV (electron volt) that can be obtained by burning 1 Kg of coal using the data from your text book (heat energy obtained by burning 1 gm of coal is 33 Kilo Joules).

10. Compare solar and voltaic cells.

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TEST MATERIALS ON ENERGY

Concept No.1 :- Energy

Test - Items:-

i) Why does a speedy bullet damage its target ?

ii) A patient is given glucose when he is not able to take normal food. Why ?

iii) What does a cyclist need to climb up a hill ?

iv) While boiling water in a closed container the lid sometimes is thrown away from the container. What is the reason ?

v) Tick the correct answer

On rubbing both hands together we feel

(i) Cold, (ii) Hot, (iii) Itching, (iv) Nothing

vi) You sweat while walking on a sunny day without an umbrella; because,

1) You received more heat energy from the Sun.

2) You walked a long distance.

3) You are frightened with a big dog.

Concept No.2 - Types of energy

Test-items

1) You are using certain things like, radio, television, torch light etc. Mention the energies related to each item.

2) A small piece of stone hurt you severely when it is dropped from a height. What is the reason?

3) During second world war, over Nagasaki and Hiroshima atom bombs were dropped. What type of energy caused the damages ?

4) Match the following:

(A)	(B)
a) Flying Kite	Chemical energy
b) Dry cells	Heat energy
c) Cooking rice	Solar energy
d) Fan	Electrical energy
e) Solar cooker	Muscular energy
f) Bulb	Kinetic energy
	Mechanical energy

5) Name any three types of energy you use at your home.

Concept No.3 - Renewable and non-renewable sources of energy.

Test-Items

1) Why do we not use the scooter all the times though it is in working condition?

2) Columbus reached America without any engine in the ship, then how did he reach ?

3) During recent Gulf-War some of the oil wells were fired at. What was the loss ?

4) Why do we feel happy if all the mines in our country would be full of coal and petroleum?

5) Sometimes somebody is dragged into the sea by the waves, what is the reason?

6) Energy of the Sun is the ultimate source of energies. Will it last for many years to come?

7) Draw a diagram of a wind mill you have seen in your locality.

Concept No.4 - Application of Energy

Test - Items

Fill in the blanks:

1) Wind mills are not only used for milling grains, but also used for _____ and _____.

2) What is the source of generation of electricity used in your house ?

3) Solar furnaces work with _____ energy.

4) The handle in a door kept at the edge. What is the reason ?

5) Wha t type of energy needed to run an engine?

6) Name the type of engine used in Rly Engine.

7) Mention the energy stored in a dry cell to produce electricity.

8) In a nuclear reactor the nuclear energy is transformed in to _____ energy to run the generator.

KEY to the test-items

Concept No.1: i) Production of energy (K.E.)
ii) To gain Energy (Muscular)
iii) Energy (Muscular)
iv) Energy (Heat)
v) (2)
vi) (1)

Concept No.2: 1) Sound, Light, Chemical energy respectively
2) Potential energy of the stone.
3) Nuclear Energy

Concept No.3: 1) To save petrol --- non-renewable resource of energy.

2) Wind - Energy --- Renewable source of energy.

3) Petroleum ----non-renewable source of energy.

4) Coal and Petrol --- non-renewable source of energy.

5) Tidal --- energy --- renewable source of energy.

6) Yes. Solar energy ---- renewable source of energy.

Concept No.4: 1) Generation of electricity and Pumping of water.

2) Solar energy

3) Consumption of less muscular energy

4) Heat energy.

5) Steam engine

6) Chemical energy

7) Heat energy.

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LECTURE METHOD - AN OVERVIEW

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Teaching catalyses students to learn. The sum total of teaching strategies have been grouped as follows: communicating through lectures, utilizing group processes, facilitating enquiring, and using self-p aced instructional systems . In all these strategies it is the communication process may be between the teacher and the pupil; pupil and pupil or the pupil and the instructional material. The communication is actually the sharing of experiences. The teacher shares his experiences with his pupils at the end of the learning process.

The learning process can be activised in a number of ways. The choice of the proper method is determined by a variety of factors (the Encyclopedia of Education,1971).

1. The type and size of the institution.
2. Level of the class.
3. Field of knowledge.
4. Facilities and financial support - library
5. Teacher-student ratio.
6. Nature of students-cultural background, educational preparation.
7. Climate of institution-faculty-student relation, institutional tradition and prestige.
8. Teachers basic concept of the purpose of education and how it can be best achieved.

Communicating through lectures is one way of doing it. This process of communication is known as the 'Lecture Method'. Lecture is generally described as a teacher-centred teaching method involving one-way communication procedure.

Lecture & Lecturing: A lecture consists of one person talking to many about a topic or theme. It is augmented by the use of audio-visual aids and by occasional questions. The recipients usually take no es and is supplemented by handouts provided by the lecturer.

Purpose: The main purposes of lecturing are as follows:

1. To convey information about a specific content matter.
2. To generate understanding of the matter.
3. To stimulate interest within learners.

The emphasis given to each of these purposes may vary between lectures, between lecturers and between academic subjects.

Intensions/objectives served by a lecture are as follows:

1. To introduce the article
2. To provide a coverage to the topic/idea of the scope and content of the article/ subject.
3. To generate understanding and to stimulate interest in the subject or line of action or thought.
4. To present a new thesis or technique.
5. To persuade pupil in their own capacity to understand or enjoy, and
6. To provide an aesthetically stimulating experience.

The Process of lecturing:

The process of lecturing include structuring and conveying ideas, procedures, facts to a group which receives, interprets and respond to the messages received. Attitudes and values may also be transmitted intentionally or unintentionally by the lecturers and by the students.

For these two reasons process of lecturing is cognitive and social activities which is an indicative of accounting of intellectual skills and interpersonal skills.

Transmission of lecturing

Lecturer sends messages verbally, extraverbally and non-verbally through use of audio-visual aids. Verbal message consists of definition, descriptions, examples, explanation and comments.

Extraverbal message is lecturer's vocal qualities, hesitations, stumbles, errors and the use of pauses and silence. Non-verbal message is lecturer's gestures, facial expressions and body movements. All the messages are received by the learners who may shift or examine closely into the matter, perhaps store, summarise and note whatever they perceive as important. Lecturer's non-verbal cues may convey meanings and attitudes which highlight, qualify or distort the essential messages.

Receipt:

The information, meaning and attitudes conveyed by the lecturer may or may not be perceived by the learners. Because, attention fluctuates throughout a one-hour lecture, during the course of lecturing after first twenty minutes there is a marked decline in attention. Peak of attention exists just before the lecture ends.

Decline in attention is less likely to occur if the lecturer includes:

(a) Some short of activities for students, such as breif small group discussions or simple problem-solving activities.

(b) Change of activity likely to renew attention. Secondly messages received by the students are filtered and stored temporarily in the short-term memory. They are forgotten after about 30 seconds if they can not be kept in mind or noted, if they can not be transferred to the long term memory. The long term memory readily receives the message which are closely related to the network of concepts and facts that are already stored in long-term memory, also store new messages which are closely associated with exciting facts and ideas. Incomprehensible facts and idens are most likely to be forgotten.

Output (Response):

Student's response is not only a set of intelligible notes which may be understood and if necessary, restructured and learnt. It consists of reactions to the lecture and the lecturer.

Immediate reactions are usually non-verbal signals and these may be received interpreted and perhaps acted upon by the lecturer.

Immediately observable responses to a lecture are of two types:

1) Long-term changes in attitude and understanding.
2) Other changes which influence over the student's attitudes towards a subject/concept and towards lecture method.

These changes are influenced by -

(a) Quality of lecturing correlating the student's previous experiences and

(b) Student's own personality characteristics.

A lecture may bring about changes in student's perception of a problem or theory, may increase student's insight and may stimulate student to read, think and discuss ideas with others.

The above mentioned changes in student is dependent on students knowledge, attitudes and motivation to learn and to a great extent dependent on lecturer's preparation before lecturing, lecture structure and lecture presentation.

Utility of lecture as a classroom technique of teaching

1. The lecture method enables the teacher:

   (a) to cover the syllabus quickly;

   (b) to collect and summarize the result of pupils' practical work;

   (c) to open up a discussion as to where previous work may be leading, and to obtain suggestions for further inquiry;

   (d) to introduce a new topic, collecting together what information the class already possesses, and outleaving the sort of information that will be sought;

   (e) to inform the class where relevant background material may be found; where certain objects may be seen, certain operation watched; in what periodical appropriate articles or advertisements may be found or looked for; in what shops certain pieces of apparatus or advertisement displays may be seen; and so on;

   (f) to economise human labour, because no laboratory, apparatus aids etc. are required and a single teacher can teach any number of students at a time which is impossible by any other method. The communication is through verbal symbols;

Techniques to Increase the Effectiveness of a Lecture

1. The lecture must have clear cut definite objectives in terms of desired changes in students' mental process and general behaviour.
2. In addition to the arrangement and linking of the points in the body of the lecture plan, the teacher has to think of the techniques by which the impact of lecture will be increased.
3. The lecture method is most effectively used when as many members of the class as possible can be drawn into a discussion, when charts bought or prepared by the teacher are ready to hand.
4. When teacher has suitable summaries in his teaching notes ready to be written on the black board.
5. The matter for summaries should, as far as possible, be obtained from the class by question and answer, the teacher must not rely on getting a complete summary in this way.

In addition to the above ingradients of lecture the following factors should be given due attention for improving the effectiveness of lecture method.(Saxena,1991)

I. Motivation:- High motivation is essential for the transfer and exchange of knowledge. The key factors may be considered as

1.1 Teacher's satisfaction:-

1.1.1 Teacher's should have job satisfaction.

1.1.2 He should be provided with clear goals but autonomy for his approach.

1.1.3 He should be recognised for his achievements, and should not have interference and directives from people less authentic than him even on higher level of hierarchi.

1.1.4 Interested teachers with aptitude in lecture or teaching should be inducted to the cadre.

1.1.5 Should never have 'Ego Barrier'.

1.1.6 Should be ready to accept ignorance and stand corrected.

1.2 Selection of group - The group should be such who really needs those lectures, & realize the utility of the subject in the work life.

1.3 Introductory brief:- About 5 minutes introduction, as to what is the applicability of the subject, and how it is relevant to the audience group/learner.

1.4 Teacher's Profile - Teacher's biodata and list of his achievements may motivate the group to listen carefully.

1.5 Summary by pupils - At the end of talk a pupil will be asked to summarize in 5 minutes the talk delivered. This will motivate participants to listen and give a nice summary which can be recognised by the teacher with a 'thank'.

2. Active involvement - Group should be actively involved to make it 'Fruitful dialogue' and not the "Dull Monologue". This can be promoted by:

2.1 Group size - It should not be very large for involvement of the pupils as well as teachers. A group of 30 to 35 pupils can be managed in classroom situation.

2.2 Communication Barrier - Noisy pl ce, te cher's voice is too low, his pr nunci ti n or writing on black board may not be clear, communic ti n may not be at some level -------- th e should be removed.

2.3 Participative method - The te cher sh uld introduce the subject and giv a direct n t the talk then at various stages he may ask the participants what todo next' and based on r sponses lead the talk to correct direction, and bridge the gap wherever required.

2.4 Talk on principles of learning

At the beginning of a session one or two lectures may be delivered on what are cognitive learning, insight learning, operant conditioning, brain and perceptory inputs, memory model, listening and its barriers like Day Dreaming, Devouring, Debating, Parallel thinking etc. Knowledge of these aspects keep the participant aware of possible distractions in the class and return him back earlier mentally in the class.

2.5 Small exercises - In between lecture small exercises may be given to the pupils to solve & teacher may take a round in class, guiding students to the extent required will help in better involvement of students in learning process.

3. Individual Approach - Individual capacity of individual learners and individual approaches of individual learners are to be taken care. This creates problem in learning which can be reduced to a extent by:

3.1 Homogeneous group -

3.1.1 Leastdifference in entry behaviour

3.1.2 Initial potential of learner to be taken into account while structuring the lecture series.

3.1.3 Group members should be given chance to be frank among themselves on admitting their ignorances and confusion about subject matter.

3.2 Develop confidence among learners:-
Individual learner should be capable of expressing his difficulties to teacher at the time of lecture. The teacher may guide him suitably to keep in pace with the class.

3.3 Sampling -
Teacher should keep eye to eye contact with students, asses individual difficulty. He may ask sample question and ascertain difficulty. He may then help and guide the student to join the main stream.

4. Sequencing & Structuring

Steps in good structuring

4.1 Planning - For planning a lecture, the lecture should know -

4.1.1 Audience, its initial potentials and what level of competence required on knowledge, skill and attitudes.

4.1.2 The subject matter, resource materials available on it and lecturer's own field experience on the matter.

4.1.3 Time available to complete the talk.

4.1.4 Training aids, audio visual aids available.

4.2 Structuring

The lecture note can be prepared by putting the things in order of steps from introduction to conclusion. Whenever time allotted is less and subject matter is more and resources permit, cyclostyled notes may be distributed in advance, and students may be asked to read the notes before coming to class. The lecture may save time on certain aspects.

4.3 Lecturer's reference cards

The lecturer should prepare list and sequence of points to be covered on card sheet or transparencies. He should also note examples or instances to be told in margin. Graphs and figures should be noted for drawing on black board etc.

5. Feed back

Feed back is an important tool to modify and restructure the lecture. Normally after a teaching programme, few questionnaire are given where in the participants have to rank a lecture or teaching programme as Excellent, good, fair etc. These type of instruments do not correctly reflect as to how the objectives set, fulfilled, participants mark the things good in view of nice meeting with people and other arrangements. Also there is no use for that particular group by taking feed back at the end. Following tools may help better.

5.1 Mid-term tests

Small objective type or problem solving tests may be given. Evaluation should be immediate and students may be called to discuss on common errors.

5.2 Informal discussion

During free time informally the lecturer may talk to the students and find out as to whether the students are learning the things properly.

6. Transfer

Lecturer should ensure as to whatever is taught to the students find use in their day-to-day working. If a student is sure that the subject matter is such that the organisational environment does not allow him to turn them to practice, he will not develop any interest. A student whose prime objective may be to pass an examination if told that a particular topic will not be asked in the examination may not give attention and loose interest. Transfer can be ascertained by post teaching survey.

7. Post Teaching Survey(PTS)

PTS may be conducted by the institution educationists to find out from learners, his boss, colleagues and subordinates about the change in the level of knowledge, skills, and attitudes of the learners before he undergoes the teaching programmes and after undergoing the same. Different instruments are used for this purpose. Findings of this survey may be used to restructure lecture series for next batches.

A skilled lecturer and an interested group can always mould the weakness of lecture method in his favour to become the strong point.

8. Don'ts for lecturers

8.1 Do not be too stylish - Lecturer should deliver the lecture in his normal way. He should not use body language too much, should have simple sober dress.

8.2 Do not cut jokes unnecessarily

No need of creating unnecessary humour by telling certain funny instances. The only objective of such gesture is to relieve the learners of strains few moments, and to clarify certain concept. Any such joke should be like a cartoon which immediately transmit a meaningful message powerfully. Lecturer should see that his purpose of imparting if meaningful knowledge may not be defeated by cutting jokes.

8.3 Do not use Audio-visuals unnecessarily

Use of excessive use of audio-visuals without thinking the impact of those. The figures etc. should be prepared neatly, in correct size of letters. Aids are to be avoided.

8.4 Do not go unprepared to class

Conclusion:- Lecture is also a strong method of learning, provided the pre-requirements are fulfilled and standards are not compromised. The prime factor is success of the lecture is the sincere involvement of teacher and learners.

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FACTORS INFLUENCING ADOLESCENT ATTITUDES TOWARDS EDUCATION

Dr. S. C. Panda

Peer attitudes - Whether they are institution oriented or work oriented.

Parental attitudes - Whether parents consider education a stepping stone to upward social mobility or just as required by law.

Grades - Which indicate academic success.

Degree of Social acceptance - among class mates success in extracurricular activities.

LEARNING STYLES:-

From the above characteristics we can infer a learning style of our target audience. Although, all of them are in the latter adolescence, they differ in their learning styles. Broadly there are four types of learning styles. They are as follows:

(a) The Activists: The activist type learners are not satisfied with any single activity. They have a tendency to change to newer activities every now and then.

(b) The Reflectives: The Reflectives are the thinking people. The reflective learners, therefore, use much of their time in thinking. Of course, they are very often creative and they engage their time in creative pursuits like poetry, painting, designing etc.

(c) The Pragmatists: The Pragmatist learners are practical in approach. They realize ideas into action keeping in view their resources.

(d) The Theorists: The Theorist are best at putting fragmented things joined together and giving every thing a theoritical shape.

TEACHING STYLES:

Like the learning styles there are different teaching styles. The teaching styles are:

(a) Direct Vs. Indirect Teaching Style:

Research studies have indicated that Direct teaching style is found effective for pupils of lower age group and those coming from the low SES. On the other hand, Indirect teaching style like soliciting the ideas of pupils, accepting and praising them have been proved influential for the older pupils and for children coming from the middle SES.(Socio-economic Status)

(b) Formal Vs. Informal Teaching Style:

Formal teaching style is mostly teaching in the formal classrooms in the educational institutions. The informal teaching on the other hand, can occur anywhere in any form. Research findings hold that all personality types can learn better under formal teaching style. However, it is held that, low ability pupils do better under informal style and high ability pupils under the formal and mixed type.

(c) Closed Vs Open Traditional Vs progressive | Teaching style

Closed Vs open teaching style is used synonymously with traditional Vs. progressive teaching style. In the traditional style things are imposed upon the child and he is bound to accept whatever is handed down to him by his teacher. This style is no more accepted at any level of teaching excepting some dogmatic preaching progressive or open style is the modern approach to teaching.

(d) Teaching Centered Vs. Pupil centered Style:

In the modern time, our education has to fulfil the needs of the child. Hence, there is no two opinion about the fact that teaching should be child centered. Now, effective teacher has to decide which of the above styles are applicable for each level students. The progressive teachers are of the view that indirect, formal, progressive and child centered styles are applicable at each level. However, while applying the teaching style the teacher has to keep in view the learning style of his pupils. Accordingly he has to adjust his strategy this way or that way.

COMPONENTS OF TEACHING:

Before finalizing the strategy for teaching One has to take into consideration the basic components of teaching. Commonly, one devides the whole process of teaching into introduction, presentation, Generalization and Application. Different names are given to these basic four steps to make them suitable for different purposes. They are as follows:

A. (i) Presage (all the knowledge, attitudes, values and personality characteristics that teachers and students bring to class room).

(ii) Context (building facilities, programme materials classroom aids and teaching climate where teaching learning occurs).

(iii) Process (interaction between teacher and taught, the activities that takes place in the classroom).

(iv) Product (the behavioural change taking place in the teacher and the pupils).

B. (i) Preparation (collect materials, clarify doubts, and prepare in order things that you need to take into the class).

(ii) Structure (It includes 4 Ps. - Position or level of the existing knowledge, Problem, that you intend to present, possibilities of solution of the problem, and Proposals that are accepted for solving the problem).

(iii) Delivery (systematically presenting the topic)

(iv) Summary (summarising the main points)

C. (i) Introduction (introduce the problem generally)

(ii) Development (go into particular details and develop concepts, understanding, attitude related to the problem one by one),

(iii) Consolidation (go from part to whole and consolidate the knowledge, understanding etc.)

(iv) Application (leave the learner to apply his knowledge, understanding etc. in life situations).

D. (i) Setting objective (what you intend to achive)

(ii) Designing process (preparation structurally putting them in right position).

(iii) Implementing process (Presentation with all possible devices and teaching aids)

(iv) Evaluating process (evaluate how far you have succeeded).

TIME MANAGEMENT:

Time management is one of the important components for successful teaching. The suggested ways of time management are as presented below, which will help vitalize the strategy adopted by the teacher.

Steps	Theory session	Practical session	Pre-Exam. session
Introduction	10%	10%	5%
Development	80%	40%	0-10%
Consolidation	10%	50%	85-95%

Teaching Methods: (Selecting the appropriate method) - Some of the methods as we know are - Quiz presentation, small group discussion and presentation, Lecture, Discovery and Investigation, Demonstration, Project, Problem solving etc. The teacher has to select the appropriate method for effective motivation, consolidation and application of the knowledge imparted.

Teaching Skills:

The teacher, to be successful, has to acquire develop and master some teaching skills. They are -

- to control the voice and pace of teaching to suit the needs of the class.
- to avoid personal mannerism, if there is any
- to avoid jargons
- to have good eye contact
- to have humour to give relief points

- to show personal interest and enthusiasm for the topic presented.
- to put questions to the needs
- to use audio-visual aids as required
- to use teachers note (introductory points, teaching points, examples, equipment, questions and answers, and exercises).

Teaching Techniques

The teacher has to adopt certain techniques to

(i) control the class (knowledge of group dynamics),

(ii) fulfil individual needs (knowledge of individual difference) and (iii) mitigate typically adolescent needs and circumstances.

A teacher must not stop here. He should think further about other strategies to strengthen his teaching.

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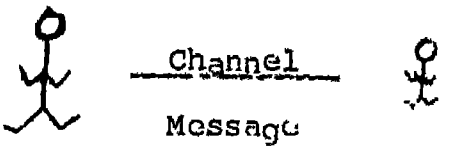
TECHNIQUES AND PRINCIPLES OF EFFECTIVE COMMUNICATION

What is communication



- An art of transmitting information ideas and attitude from one person to another.
- It is a necessity and a primal urge for survival.
- Sharing of ideas and feelings in a mood of mutuality.
- It involves interaction which encourages give, and take. Feed back to personnel involved in exchanging ideas.
- Effective communication is two-way process including feedback and interaction.
- Anything that conveys meaning, that comes a message from one person to another.

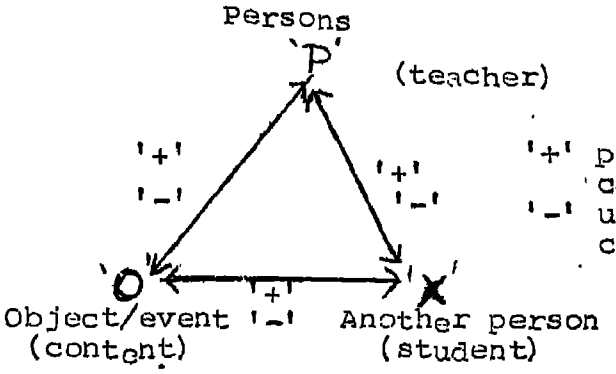
Purpose of communication is to change/alter

- cognitive change (knowledge, thinking, reasoning etc).
- Conative change (verbal skills, handling, drawing, writing etc.)
- Affective change (personality, attitude, behaviour feeling etc.)

Theory of Communication

by Heider - Theory of Balance

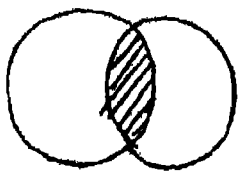
Unless and untill you have a balanced communication it is not effective.



1) Untill and unless there is proper understanding i.e., balanced communication between person (teacher) and another person (student) communication is not effective.

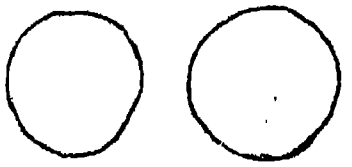
2) Unless and untill there is proper understanding between person (teacher) and object/event (content) communication is not effective. How this balanced communication happened ? On this issue there are <u>two concepts</u>.

(1) <u>Homophili</u>



More the homophilous more the contact

(2) <u>Haterophili</u>



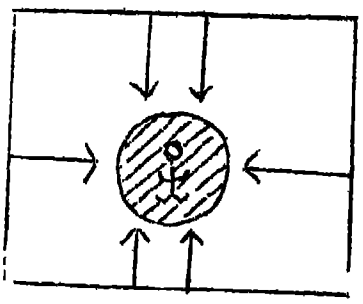
More the haterophilous less the contact

<u>COMMUNICATION IN CLASSROOM:</u>

Communication channel in the classroom should ideally carry both messages and counter-messages.

- It involves initiation, reception and response which serves as feed back.
- Brown says everything goes on in a class in some way is considered as some form of communication. Classrooms are set up for the purpose of communicating and learning is contingent upon its taking place.

So communication skills always are a basic concern of the school which can be taught and improved. Students have many daily out of school contact with a wide variety of mass media which influence knowledge, attitude, standards, habits and even health. Teacher should know the extent and equality of these contacts and their possible effects. Moreover teachers need to know communication tools and to use new improved communication devices to meet special instructional problems.



Stimuli

(arrow) marks are stimuli or influences that fall upon the learners' sense perception through which he learns.

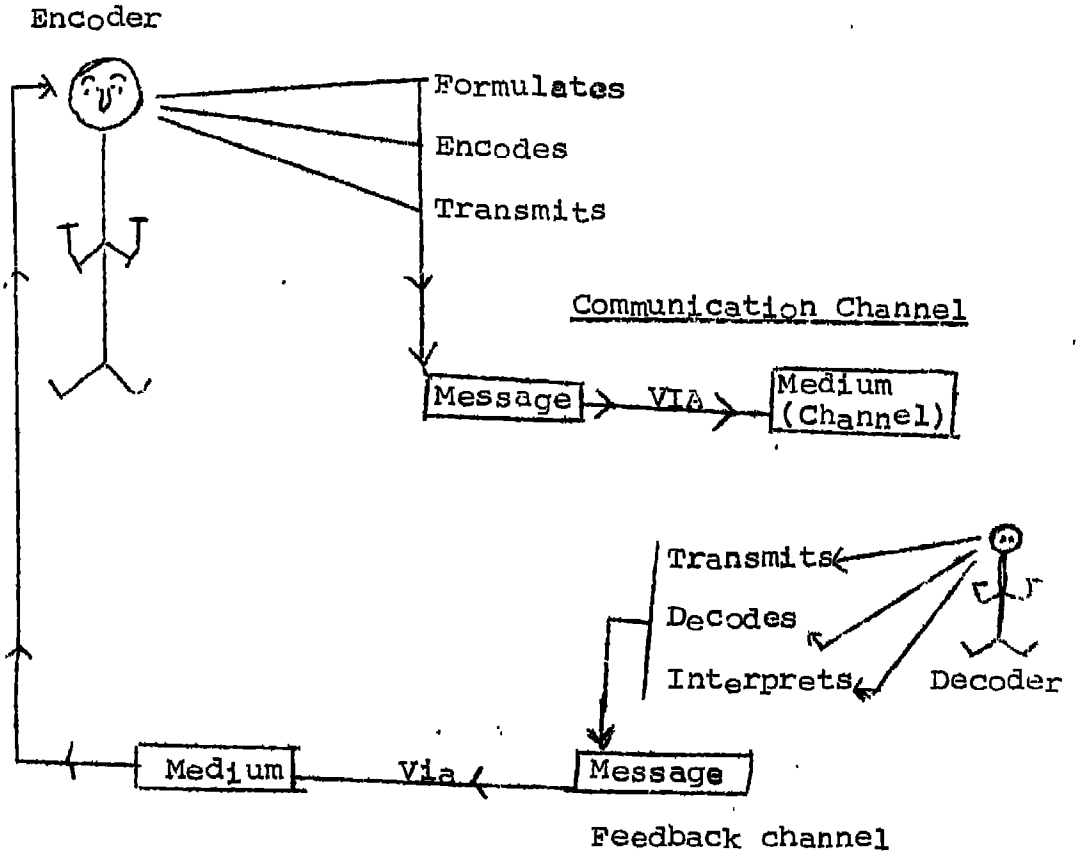
-is his internal condition i.e. interests, attitudes aptitudes in respect of learning activiti es.

Selected by teacher to impart knowledge, present facts, demonstrate skills, stimulate imagination, influence students and so on.

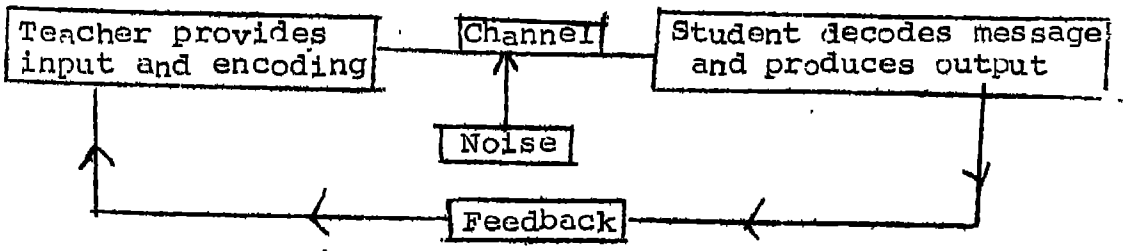
Internal condition - refers to age, interest, ability intelligence, knowledge, physiological condition, experience of life and experience of learning by means of books, pictures, radio etc.

Components of Communication:

1) Encoder (Communicator or Sender or Source)
2) Message or signal (words, pictures, signs, symbol etc.)
3) Channel (medium) - (media or means)
4) Decoder (Receiver or audience or destination).



Communication Cycle



Noise:- Anything which interferes with transmission of the message (sources of noise in teaching and learning).

1) The teaching environment itself.

Factors include: Qualities of comfort of chairs, Visual impact of colour of walls and floor covering, Sound quality, Special dimension(Sound, faint images, poor print, vibration, temperature etc.)

2) Size of the group contribute physical noise especially for those sitting at the back.

3) The teacher himself (To reduce noise as much as possible he must:-

a) be clear as to his purpose

b) ensure that material is clear and unambiguous

c) Choose appropriate channels of communication.

d) use variety of techniques as appropriate

e) cautions as regards loudness, clarity and speed of delivery.

Essential elements in communication process including feedback summarised by Harald D. Lasswell.

1) Who ? - Teacher, Textbook writer, T.V. presenter, Radio broadcaster and so on.

2) Says what ? - Contact of the lesson and text book etc.

3) In which channel ? - face to face speech, picture, films, slides, radio, T.V. etc.

4) To whom ? - Learners.

5) With what effect ? - Reac-tion or feedback.

Types of Communication:

1) Speaking - Listening

a) Interaction face to face (in case of listening lectures)

b) Sharing of feelings of the source (listening to radio programmes).

2) Visualising - Observing:

Observer is physically separated from its producer, yet is able to feel that impact of the ideas conveyed, (TV, motion films, and dramatisation etc.)

3) Writing - Reading:

Decoder (receiver) is physically separated from the encoder (Source) all the time yet the decoder is able to enjoy and appreciate the feeling of the author (encoder).

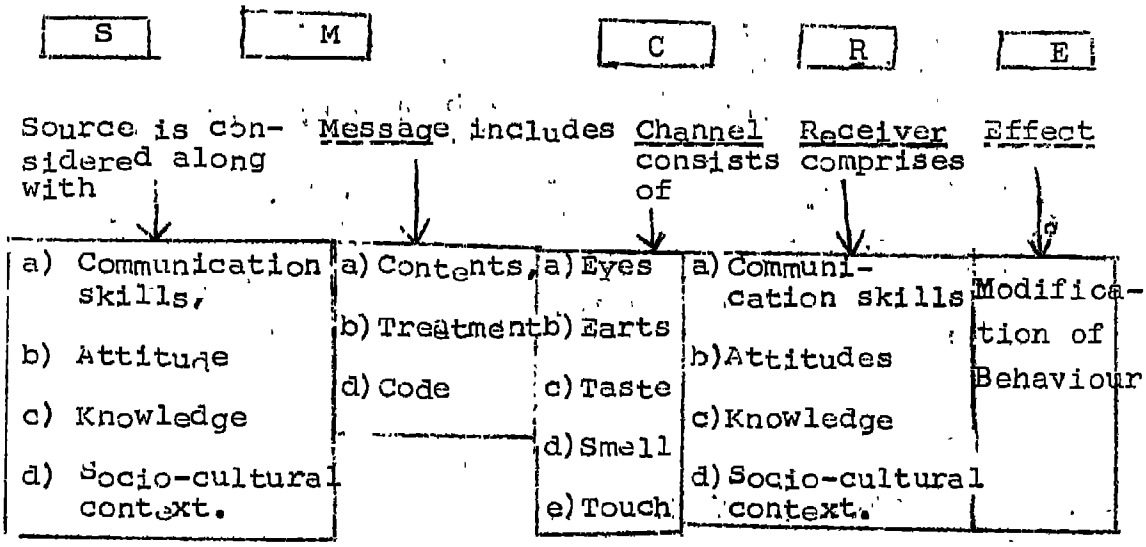
Modified Model of Communication by David K Berlo (SMCRE)

This is used in various training programmes.

a) Emphasizing the psychological nature of communication.

b) Providing an analysis of messages.

c) Analysing sensory channels of communication.



Types of Receiver - Early adoptors

- Early rejecters

- Late adopters

- Late rejecters

It is clear from SMCRE model of Barlo that

a) to encode or decode a message successfully will depend heavily upon the communication skills of source.

b) and receiver 's attitudes that are mainly "Predisposition to response in situation".

From the above discussion it is evident that the Encoder should be fully aware of (1) what he wants to communicate. (2) He should understand the

characteristics of the channel to be used as media. (3) He should have knowledge of the physical, social, emotional and psychological background of the decoder. (4) He should be able to analyse the bouncing effects or reactions of the decoder which will help him to modify or revise his media or channel and (5) give message according to feedback effects.

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LIST OF PARTICIPANTS AND INTERNAL AND EXTERNAL RESOURCE PERSONS ATTENDED IN TRAINING PROGRAMME IN GENERAL SCIENCE FOR KEY RESOURCE PERSONS AT SECONDARY LEVEL FOR THE STATES OF MEGHALAYA, MIZORAM AND TRIPURA.

Venue:- TGT College, Shillong Duration:-27.1.94 to 3.2.94

PARTICIPANTS

1. Sri Sunil Ch.Debnath,
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3. Dr.S.C.Panda,
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   RCE, Bhubaneswar.

4. Dr.B.K.Parida,
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   R.C.E., Bhubaneswar.

5. Dr.G.V.Gopal,
   Sr.Lecturer in Botany &
   Programme Coordinator,
   RCE, Bhubaneswar.

EXTERNAL RESOURCE PERSON

1. Dr. C.Wolflang,
   Director,
   SCERT, Meghalaya,
   Shillong.

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TRAINING OF KEY RESOURCE PERSONS IN GENERAL SCIENCE AT SECONDARY LEVEL OF MEGHALAYA, MIZORAM, AND TRIPURA AT SHILLONG, MEGHALAYA

Venue: Shillong (PGT College)

TIME TABLE

Duration: 27.1.94 to 3.2.94

Day and Date	9.30AM - 10.30AM	10.30AM - 11.30AM	11.30AM - 12.30PM	12.30PM - 1.30PM	1.30-2.30	2.30-3.30	3.30-4.30PM
27.1.94 Thursday	Registration	Inauguration	Presentation of paper & general discussion with RP.	Zoology (UKN)	L U N C H B R E A K	Physics practicals (BKP)	
28.1.94 Friday	Chemistry (HHT)	Physics (BKP)	Zoology (UKN)	Concept & Principle teaching & learning. (SCP)		Zoology Practicals (UKN)	
29.1.94 Saturday	Botany (GVG)	Physics (BKP)	Chemistry (HHT)	Zoology (UKN)		Chemistry Practical (HHT)	
30.1.94 Sunday	Botany (GVG)	Chemistry (HHT)	Education (SCP)	Education ERP (Dr.C.Wolflang)		Botany Practicals (GVG)	
31.1.94 Monday	Zoology (UKN)	Botany (GVG)	Chemistry (HHT)	Physics (BKP)		Botany Practicals (GVG)	
1.2.94 Tuesday	Physics (BKP)	Botany (GVG)	Chemistry (HHT)	Education (ERP (Dr.C.Wolflang)		Physics Practicals (BKP)	
2.2.94 Wednesday	Zoology (UKN)	Physics (BKP)	Physics (DKP)	Chemistry (HHT)		Zoology Practicals (UKN)	
3.2.94 Thursday	Physics (BKP)	Chemistry (HHT)	Education (SCP)	Physics (BKP)		Valedictory and disbursement of TA/DA.	

Vijaya Gopal

(Dr.G.V.Gopal)
PROGRAMME DIRECTOR

THE MEGHALAYA GUARDIAN

SHILLONG SATURDAY JANUARY 29, 1994

Call to improve science teaching

By Staff Reporter

SHILLONG, JAN. 28: The "course content enrichment programme in general science for teachers persons working at secondary level" which began today at the PGT college was inaugurated by Dr C. Wolflang director, SCERT.

The orientation in general science which will conclude on February 3, is being conducted by the department of science, Regional College of Education Bhubaneswar under the programm directorship of Dr G.V. Gopal.

In his inaugural speech, Dr Wolflang expressed that the rich economic potential of the State which has to be utilized scientifically.

He stressed the need for improving science teaching in the schools, exhorted the teachers to the devotional and dedicated to the noble causes of humanity.

He observed that since scientific knowledge needed to be upgraded, the courses should be designed to develop the economy of the nation through using technology and that for all the purposes science teaching should be activity based.

Presiding over the function Dr M.M. Pandey, field advisor NCERT, stressed the need for orientation courses to freshen the teachers and to upgrade their knowledge in the light of developmental effects in the field of general science teaching. He said as emphasised by all concerned on the improvement of science education at school level, the teachers should have to evolve their own practical methods of communication to the students.

Students should not be taxed with theoretical knowledge only but practical and application part of the science teaching should be given due weightage, he observed.

The welcome address was given by Dr H.H. Tripathy. Dr G.V. Gopal outlined the objectives of the orientation programme. The vote of thanks was tendered by Dr U.K. Nanda.